Emotionen und der kompetente Einsatz von Lernstrategien in der Schule

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I Rahmenpapier

Emotionen und der kompetente Einsatz von Lernstrategien in der Schule

Inhalt

Emotionen und der Einsatz von Lernstrategien sind wichtige Faktoren für einen erfolgreichen Lernprozess (Hattie & Donoghue, 2016; Pekrun, Lichtenfeld, Marsh, Murayama, & Goetz, 2017). Ihr Zusammenspiel ist jedoch noch nicht hinreichend erforscht. Die vorliegende artikelbasierte Dissertation soll einen Beitrag zur Schließung dieser Forschungslücke leisten. In den drei im Rahmen der Dissertation verfassten Artikeln werden Zusammenhänge zwischen den Lern- und Leistungsemotionen von Schülerinnen und Schülern und deren Lernstrategieeinsatz analysiert. Dabei wird die zentrale Rolle eines selbstregulierten und kompetenten Einsatzes von Lernstrategien berücksichtigt.

Schülerinnen und Schüler erleben beim Lernen eine Vielzahl von Emotionen (Pekrun, Muis, Frenzel, & Götz, 2018). Besonders positiven Emotionen, wie beispielsweise der Freude, wird eine unterstützende Wirkung zugeschrieben, wohingegen negative Emotionen, wie zum Beispiel Langeweile oder Angst, meist als lernhinderlich gesehen werden (Pekrun & Linnenbrink-Garcia, 2014). Ebenfalls als positiv wird der Einsatz von Lernstrategien für das Lernen gesehen (Hattie & Donoghue, 2016). Ein selbstregulierter Einsatz von Lernstrategien geht langfristig mit guten Leistungen bei Lernenden einher (Dent & Koenka, 2016; Donker, de Boer, Kostons, van Dignath Ewijk, & van der Werf, 2014) und kann erfolgreich trainiert werden, wie sich in zahlreichen Trainingsmaßnahmen zeigte (Dignath & Büttner, 2008).

Ein mögliches Zusammenspiel von Emotionen und dem Einsatz von Lernstrategien im Lernprozess wird im Rahmen der Kontroll-Wert-Theorie (Pekrun, 2006) beschrieben. Pekrun geht davon aus, dass sich Emotionen und der Einsatz von Lernstrategien wechselseitig beeinflussen. Obwohl in der Kontroll-Wert-Theorie intraindividuelle Zusammenhänge zwischen Emotionen und dem Einsatz von Lernstrategien angenommen werden, stützen sich die meisten bisherigen Studien zum Thema auf die Analysen interindividueller Beziehungen (Molenaar & Campbell, 2009). In dieser Arbeit werden daher die Beziehungen zwischen Emotionen und dem Einsatz von Lernstrategien auch anhand von intraindividuellen Analysen untersucht. Es werden erste Erkenntnisse zu beiden Wirkrichtungen gewonnen: dem Einfluss von Emotionen auf den Einsatz von Lernstrategien und dem Einfluss des Einsatzes von Lernstrategien auf die Emotionen der Lernenden. Gleichzeitig wird die zentrale Rolle einer selbstregulierten und kompetenten Anwendung von Lernstrategien berücksichtigt. Nur wenn Lernstrategien kompetent angewendet werden, können sie sich positiv auf den Lernprozess auswirken.

Viele Schülerinnen und Schüler wenden Lernstrategien jedoch nicht von selbst an, sondern präferieren andere Zugänge zum Lernen (Sontag, Stoeger, & Harder, 2012).

Inwiefern Emotionen damit zusammenhängen, ob Lernende einen selbstregulierten Zugang zum Lernen präferieren, wurde im Rahmen dieser Arbeit analysiert. Ebenso untersucht wurde die Frage, ob Emotionen und die Präferenz für einen selbstregulierten Zugang zum Lernen möglicherweise gemeinsame Auswirkungen darauf haben, wie kompetent Lernende Lernstrategien tatsächlich einsetzen.

Schließlich stellte sich die Frage, ob die beiden Aspekte – Emotionen und Lernstrategien – gemeinsam dazu beitragen können, das häufig untersuchte Phänomen Underachievement zu erklären. Sowohl Emotionen als auch mangelnde Kompetenz beim Einsatz von Lernstrategien gelten neben motivationalen Defiziten als wichtige Faktoren für Underachievement bei Lernenden (Reis & McCoach, 2000). Diese Faktoren wurden jedoch bislang noch nicht differenziert und gleichzeitig untersucht. Daher wurde in dieser Arbeit analysiert, inwieweit Emotionen und der Einsatz von Lernstrategien zur Vorhersage beitragen, ob Schülerinnen und Schüler hinter ihrem Leistungspotenzial zurückbleiben. Des Weiteren wurde untersucht, ob diese beiden potenziellen Risikofaktoren für Underachievement – Emotionen und mangelnde Kompetenz beim Einsatz von Lernstrategien – durch eine Trainingsmaßnahme zur Förderung selbstregulierten Lernens positiv beeinflusst werden können.

Im Folgenden werden im Abschnitt 1 die theoretischen und empirischen Grundlagen der Arbeit dargelegt. Darauf aufbauend werden im Abschnitt 2 die Ziele der vorliegenden Arbeit erläutert. Im Abschnitt 3 folgt ein Überblick über die drei in den Kumulus einfließenden Artikel, wobei an dieser Stelle auch die Wahl der jeweiligen Untersuchungsmethoden begründet wird und die jeweiligen Untersuchungsergebnisse dargelegt werden. Im Abschnitt 4 werden die Ergebnisse in Bezug auf die Ziele der Arbeit zusammenfassend dargestellt und diskutiert. Dabei werden auch Schlussfolgerungen für die Praxis abgeleitet, die Limitationen der Arbeit erläutert und künftiger Forschungsbedarf aufgezeigt.

1 Theoretischer und empirischer Hintergrund

In diesem Abschnitt erfolgt zunächst eine Darstellung theoretischer Zugänge zum Thema Emotionen anhand von Emotionen, die für den schulischen Lernprozess bedeutsam sind (1.1). Anschließend wird die Bedeutung eines selbstregulierten und kompetenten Einsatzes von Lernstrategien für einen erfolgreichen Lernprozess dargelegt (1.2), bevor bisherige Erkenntnisse zum Zusammenhang zwischen Emotionen und einem selbstregulierten und kompetenten Einsatz von Lernstrategien zusammenfassend erläutert werden (1.3).

1.1 Für den schulischen Lernprozess bedeutsame Emotionen

Emotionen spielen im Lernprozess eine wichtige Rolle. Sie können Lernprozesse initiieren, unterstützen, aber auch behindern (Pekrun, 2011). Über die Definition des Emotionsbegriffes herrscht jedoch keine Einigkeit. Viele Definitionen stimmen aber darin überein, dass es sich bei Emotionen um mehrdimensionale Konstrukte handelt, die aus einem affektiven Kern sowie kognitiven, physiologischen, expressiven und motivationalen Komponenten bestehen (Kleinginna & Kleinginna, 1981; Scherer, 2005; Shuman & Scherer, 2014). So kann sich die Angst einer Schülerin oder eines Schülers vor einer bevorstehenden Prüfung beispielsweise darin zeigen, dass sie bzw. er sich unwohl fühlt (affektiver Kern), sich überlegt was passiert, wenn sie bzw. er die Prüfung nicht besteht (kognitive Komponente), einen erhöhten Puls hat (physiologische Komponente), einen ängstlichen Gesichtsausdruck zeigt (expressive Komponente) und das Klassenzimmer gerne verlassen würde (motivationale Komponente).

Emotionen können aus einer dimensionalen und einer kategorialen Perspektive betrachtet werden. In dimensionalen Ansätzen wird eine begrenzte Anzahl an Dimensionen angenommen, mit denen das subjektive Emotionserleben beschrieben werden kann. Häufig genutzt werden dabei die Dimensionen Valenz (positiv bis negativ) und Aktivierung/Erregung (hoch bis niedrig) (Feldman Barrett, & Russell, 1998; Larsen & Diener, 1992; Russell, 1980). In kategorialen Ansätzen werden viele qualitativ unterschiedliche („diskrete“) Emotionen differenziert, sodass sich eine Vielzahl unterschiedlicher Emotionen benennen lässt. Der Unterschied zwischen beiden Perspektiven zeigt sich gut am Beispiel der Emotionen Ärger und Angst. Während aus dimensionaler Perspektive beide Emotionen gleich beschrieben werden, nämlich „negativ erregt“, handelt es sich aus kategorialer Perspektive bei Ärger und Angst um zwei getrennte Emotionen.

Diese unterscheiden sich trotz ihrer Ähnlichkeit in den Dimensionen Valenz und Aktivierung stark in ihrem subjektiven Erleben.

In der Forschung spielt es eine Rolle, ob Emotionen habituell oder situationsspezifisch sind und in welchem zeitlichen Rahmen sie sich abspielen. So differenzieren Cattell und Scheier (1961) sowie Spielberger (1972) zwischen sogenannten State- und Trait-Emotionen. Während State-Emotionen situationsspezifisch und nur von kurzer Dauer sind, werden unter Trait-Emotionen habituelle, wiederkehrende Emotionen verstanden, zu deren Empfinden ein Individuum in bestimmten Situationen neigt.

Beim schulischen Lernen berichten Lernende besonders häufig über die Emotionen Freude, Langeweile, Angst und Ärger (Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007; Pekrun, Goetz, Titz, & Perry, 2002). Auf diesen Lern- und Leistungsemotionen liegt der Fokus der vorliegenden Arbeit. Unter Lern- und Leistungsemotionen („achievement emotions“) werden Emotionen verstanden, die Lernende in Bezug auf leistungsbezogene (Lern-)Aktivitäten oder deren Ergebnisse (Erfolg oder Misserfolg) zeigen (Pekrun, 2006). Der Bezug auf Aktivitäten oder Ergebnisse wird als Objektfokus bezeichnet. Aus der Kombination von Objektfokus, Valenz und Aktivierung ergibt sich nach Pekrun (2011) in Anlehnung an dimensionale Emotionsmodelle eine dreidimensionale Taxonomie von diskreten Lern- und Leistungsemotionen. Freude ist demnach eine positiv aktivierende Emotion, die sich sowohl auf Lernaktivitäten als auch deren Ergebnis beziehen kann. Langeweile hingegen ist eine negativ deaktivierende Emotion, die sich vorwiegend auf die Lernaktivität selbst bezieht. Angst und Ärger gehören zu den negativ aktivierenden Emotionen, wobei sich Angst vorwiegend auf das Ergebnis der Lernaktivität bezieht, während sich Ärger sowohl auf die Aktivität als auch auf das Ergebnis beziehen kann.

Zur Erklärung, wann Lernende welche Emotionen konkret erleben, werden häufig Appraisal-Theorien herangezogen. In diesen Theorien wird angenommen, dass es nicht die Situation an sich ist, die eine bestimmte Emotion bei einer Person auslöst, sondern deren individuelle kognitive Bewertung. Verschiedene Bewertungsprozesse einer Situation („Appraisals“) können zur Entstehung von Emotionen herangezogen werden. Dazu gehören beispielsweise Bewertungen der Zielkongruenz, der Ergebniswahrscheinlichkeit oder des eigenen Fähigkeitspotenzials (Moors, Ellsworth, Scherer, & Frijda, 2013). Für die Entstehung von Lern- und Leistungsemotionen sind, der Kontroll-Wert-Theorie (Pekrun, 2006) zufolge, die subjektive Kontrolle und der subjektive Wert am bedeutendsten. Die beiden Konstrukte vereinen mehrere Appraisal-Dimensionen aus traditionellen Appraisal-Theorien. Unter dem Begriff der subjektiven Kontrolle werden Appraisals zur Kontrolle von (Lern-)Aktivitäten sowie deren Ergebnisse verstanden („controlability“). Dabei kann die

Kontrolle durch das Individuum selbst oder durch externale Faktoren ausgeübt werden („agency“). Die subjektive Wahrscheinlichkeit, ein bestimmtes Ergebnis zu erreichen („probability“), wird ebenfalls dem Begriff der subjektiven Kontrolle zugeordnet. Unter dem Begriff des subjektiven Wertes werden im Rahmen der Kontroll-Wert-Theorie die wahrgenommene Bedeutung eines Zieles (d. h. die Antwort auf die Frage „Wie viel bedeutet mir dieses Ziel?“ – „goal relevance“) und die wahrgenommene Richtung im Sinne der Zielerreichung (d. h. die Antwort auf die Frage „Bringt mich die Situation meinem Ziel näher oder rückt mein Ziel durch sie in weite Ferne?“ – „goal congruence“) zusammengefasst (Pekrun & Perry, 2014). Der Kontroll-Wert-Theorie (Pekrun, 2006) zufolge entscheiden verschiedene Konstellationen von Kontroll- und Wert-Appraisals darüber, welche Emotion im Lernprozess erlebt wird.

Freude, eine positive aktivierende Emotion, wird im Lernprozess demnach dann erlebt, wenn eine Lernende oder ein Lernender einer Lernaufgabe einen positiven Wert beimisst und sie oder er davon ausgeht, die Erledigung der Aufgabe sowie ihr Ergebnis ausreichend kontrollieren zu können (Pekrun, 2006). Subjektive Kontrolle zeigte sich in empirischen Studien als zentral für das Erleben von Freude (Goetz, Frenzel, Stoeger, & Hall, 2010). Positive Veränderungen im Erleben von Kontrolle führten zu positiven Veränderungen bezüglich der Freude im Lernprozess (Buff, 2014).

Langeweile, eine negativ deaktivierende Emotion, wird der Kontroll-Wert-Theorie zufolge dann erlebt, wenn eine Lernende oder ein Lernender eine Lernaufgabe weder positiv noch negativ bewertet (Pekrun, 2011). Csikszentmihalyi (1975) geht davon aus, dass Langeweile dann erlebt wird, wenn die Fähigkeiten der oder des Lernenden im Vergleich zur Aufgabenstellung hoch sind, sodass sie oder er eine sehr hohe subjektive Kontrolle empfindet. Die oder der Lernende erlebt dann Langeweile aufgrund von Unterforderung. In der Kontroll-Wert-Theorie (Pekrun, 2006) wird jedoch noch ein weiterer Zusammenhang postuliert. Demzufolge könnte Langeweile auch erlebt werden, wenn ein Mangel an Kontrolle über die Aufgabe erlebt wird, weil die gestellten Anforderungen höher sind als die Fähigkeiten der oder des Lernenden. Sie oder er erlebt dann Langeweile durch Überforderung. Diese Annahmen werden in verschiedenen Studien bestätigt (z. B. Acee et al., 2010; Goetz, Pekrun, Hall, & Haag, 2006; Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). Forschungsergebnisse von Niculescu, Tempelaar, Dailey-Hebert, Segers und Gijselaers (2016) weisen darauf hin, dass ein Absinken von subjektiver Kontrolle und subjektivem Wert zu einem Anstieg von Langeweile führt.

Angst, eine negativ aktivierende Emotion, tritt vor allem dann auf, wenn eine Lernende oder ein Lernender der Lernaufgabe einen hohen subjektiven Wert beimisst, sie oder er aber gleichzeitig wenig Kontrolle über das Lernen erlebt und deshalb einen Misserfolg für wahrscheinlich hält (Pekrun, 2006). Studien zur Prüfungsangst bestätigen, dass diese sehr eng mit einem subjektiven Mangel an Kontrolle über die Leistung in Verbindung steht. Dies zeigt sich beispielsweise an niedrigen Selbstwirksamkeitserwartungen bei prüfungsängstlichen Schülerinnen und Schülern (Zeidner, 1998).

Ärger, ebenfalls eine negativ aktivierende Emotion, wird erlebt, wenn eine Lernende bzw. ein Lernender einer Aufgabe keinen Wert beimisst, sie oder er diese jedoch trotzdem erledigen muss. Ärger kann auch auftreten, wenn die oder der Lernende die Lernaufgabe wertschätzt, jedoch einen Misserfolg beim Lernen erlebt und diesen nun auf ihr bzw. sein eigenes Fehlverhalten zurückführt, welches sie bzw. er hätte vermeiden können (Pekrun, 2006; Weiner, 1985). Ein weiterer Grund für Ärger kann darin liegen, dass eine Lernende bzw. ein Lernender den Grund für einen Misserfolg nicht bei sich selbst, sondern in einer anderen, von ihm nicht kontrollierbaren Ursache sieht. Demnach misst sie oder er der Lernaufgabe zwar einen hohen Wert bei, sieht aber das Ergebnis nicht unter ihrer bzw. seiner Kontrolle. Dies kann ebenfalls zum Erleben von Ärger führen (Pekrun & Perry, 2014).

Valenz und Aktivierung werden mit spezifischen Effekten auf Motivation und Verhalten von Lernenden verbunden. Pekrun (2006) geht in seinem Modell davon aus, dass positiv aktivierende Emotionen wie Freude das Engagement und die Anstrengung beim Lernen fördern, während negativ deaktivierende Emotionen wie Langeweile das Engagement beim Lernen reduzieren. Bei negativ aktivierenden Emotionen wie Ärger und Angst scheinen die Zusammenhänge ambivalenter zu sein. So geht er davon aus, dass Angst und Ärger die intrinsische Motivation reduzieren, gleichzeitig aber die extrinsische Motivation erhöhen können, sich anzustrengen, damit Misserfolge vermieden werden. Angst wird jedoch bei zu starker Ausprägung teilweise auch eine lähmende Wirkung zugeschrieben (Pekrun et al., 2002).

In der Kontroll-Wert-Theorie (Pekrun, 2006) werden jedoch nicht nur Verbindungen zwischen Emotionen und Motivation von Lernenden nahegelegt, sondern enge Verbindungen zwischen Emotionen und Lernverhalten postuliert. Die subjektive Kontrolle sollte dabei in direkter Verbindung mit dem kompetenten Einsatz von Lernstrategien stehen. Lernende, die über eine lange Zeit Lernstrategien einsetzen, erleben sich als erfolgreicher (Murayama, Pekrun, Lichtenfeld, & vom Hofe, 2013). Das heißt, Lernerfolg wird durch den Einsatz von Lernstrategien kontrollierbar. Damit sollte der Einsatz von Lernstrategien über veränderte Kontroll-Appraisals das Erleben von Lern- und Leistungsemotionen

beeinflussen. Gleichzeitig sollen Emotionen der Kontroll-Wert-Theorie (Pekrun, 2006) zufolge Auswirkungen auf den Einsatz von Lernstrategien haben. Da diese beiden Wirkrichtungen noch nicht systematisch untersucht wurden, besteht ein Anliegen dieser Arbeit in der Analyse der Wirkrichtungen zwischen Emotionen und Lernstrategien. Damit dies in der Tiefe geschehen kann, wird im folgenden Abschnitt zunächst die Bedeutung eines selbstregulierten und kompetenten Einsatzes von Lernstrategien für einen erfolgreichen Lernprozess dargelegt.

1.2 Die Bedeutung eines selbstregulierten und kompetenten Einsatzes von Lernstrategien in einem erfolgreichen Lernprozess

Der (kompetente) Einsatz von Lernstrategien ist ein essenzieller Bestandteil zahlreicher Modelle selbstregulierten Lernens (z. B. Boekaerts, 1996; Winne & Hadwin, 1998; Zimmerman, 2000). Im Rahmen sozial-kognitiver Lerntheorien definiert Pintrich (2000, S. 453) selbstreguliertes Lernen als „an active, constructive process whereby learners set goals for their learning and then monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and contextual features in the environment". Metaanalysen zeigen, dass selbstreguliertes Lernen bereits im Grundschulalter erfolgreich gefördert werden kann. Dies gilt insbesondere dann, wenn der Fokus auf der Vermittlung von kognitiven in Kombination mit metakognitiven Lernstrategien liegt und die Anwendung der Strategien ausreichend prozeduralisiert wird (Dignath & Büttner, 2008). Kognitive Lernstrategien unterstützen Lernende bei der Selektion, Verarbeitung und Speicherung von Informationen (Weinstein, Husman, & Dierking, 2000). Zu ihnen gehören Wiederholungs-, Organisations- und Elaborationsstrategien (Weinstein & Mayer, 1986). Wiederholungsstrategien beinhalten die Wiederholung von Lerninhalten. Unter Organisationsstrategien werden ordnungsbildende Strategien verstanden, mithilfe derer wichtige Lerninhalte ausgewählt, gegliedert und zu größeren Sinneinheiten zusammengefasst werden. Elaborationsstrategien werden verwendet, um neue Informationen in bestehende Wissensstrukturen zu integrieren (Weinstein et al., 2000). Bezug nehmend auf die Tiefe der Informationsverarbeitung werden Wiederholungsstrategien manchmal als oberflächenverarbeitende Lernstrategien bezeichnet, wohingegen Organisationsstrategien und Elaborationsstrategien zum Teil als tiefenverarbeitende Lernstrategien bezeichnet werden (Marton & Säljö, 1976).

Metakognitive Lernstrategien beziehen sich nicht direkt auf den Lerninhalt, sondern bezeichnen Strategien, mit deren Hilfe der eigene Lernprozess kontrolliert und gesteuert wird (Flavell, 1979). Sie tragen dazu bei, dass kognitive Lernstrategien optimal eingesetzt

werden, und beinhalten beispielsweise das Setzen von Zielen zu Beginn des Lernprozesses, die Auswahl geeigneter kognitiver Strategien zur Erreichung dieser Lernziele, das Überwachen des Lernfortschrittes sowie, falls dies nötig ist, das Anpassen der verwendeten Strategien, um die gesetzten Lernziele zu erreichen (Veenman, van Hout-Wolters, & Afflerbach, 2006).

In mehreren Metaanalysen wurde die Bedeutung von Lernstrategien für gute Leistungen herausgearbeitet (de Boer, Donker, Kostons, & van der Werf, 2018; Dent & Koenka, 2016; Donker et al., 2014; Hattie, Biggs, & Purdie, 1996). Murayama und Kollegen (2013) konnten nachweisen, dass der Einsatz kognitiver Strategien für die Zunahme von Leistung über mehrere Jahre wichtiger ist als die Intelligenz der Lernenden. Trotz ihrer Bedeutung für einen erfolgreichen Lernprozess präferieren Lernende es nicht zwangsläufig, Lernstrategien selbstreguliert einzusetzen. Häufig bevorzugen sie, dass Lehrkräfte oder Eltern den Lernprozess external steuern, oder sie gehen impulsiv an das Lernen heran, ohne vorher über den Einsatz geeigneter Lernstrategien nachzudenken (Sontag et al., 2012). Eine Erklärung für diesen Befund kann eine mangelnde Vermittlung von Lernstrategien im Unterricht sein. Im Kontext der Emotionsforschung erscheint wichtig, dass möglicherweise nicht nur das Lernverhalten und der tatsächliche Einsatz von Lernstrategien Zusammenhänge mit Lern- und Leistungsemotionen zeigen (Pekrun & Linnenbrink-Garcia, 2014), sondern auch die Präferenz für deren selbstregulierten, external gesteuerten oder impulsiven Zugang zum Lernen. Wie Lern- und Leistungsemotionen mit dem Lernverhalten, dem Einsatz von Lernstrategien und möglicherweise mit der Präferenz für den selbstregulierten Einsatz von Lernstrategien von Schülerinnen und Schülern verbunden sein könnten, welche Befunde es hierzu bereits gibt und welche Forschungslücken bestehen, wird im nächsten Abschnitt dargelegt.

1.3 Bisherige Erkenntnisse zum Zusammenhang zwischen Emotionen und einem selbstregulierten und kompetenten Einsatz von Lernstrategien

Theoretischen Annahmen zufolge können einerseits Emotionen von Lernenden den Einsatz von Lernstrategien beeinflussen, andererseits kann auch der Einsatz von Lernstrategien die Emotionen der Lernenden beeinflussen (Pekrun, 2006; Pekrun & Perry, 2014). Positive Emotionen wie Freude erleichtern demnach den Einsatz von Lernstrategien, da kognitive Ressourcen geschont werden und die Aufmerksamkeit auf die Aufgabe gerichtet werden kann. Negative Emotionen wie Langeweile hingegen behindern den Einsatz von Lernstrategien, da kognitive Ressourcen sowie die aufgabenbezogene Aufmerksamkeit reduziert werden (Pekrun, 2006; Pekrun & Perry, 2014).

Umgekehrt wird angenommen, dass sich der Einsatz von Lernstrategien auf das Erleben von Emotionen auswirkt. Der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) zufolge sind subjektive Kontrolle und subjektiver Wert mitentscheidend dafür, welche Emotionen Lernende erleben. Es wird angenommen, dass Lernende durch den kompetenten Einsatz von Lernstrategien mehr Kontrolle über ihren Lernprozess gewinnen und sich dies über Kontroll-Appraisals auf ihre Emotionen auswirkt. Die Forschung zeigt, dass Zunahmen von subjektiver Kontrolle und subjektivem Wert langfristig ein erhöhtes Erleben von Freude und ein verringertes Erleben von Langeweile aufgrund von Überforderung prädizieren (Buff, 2014; Niculescu et al., 2016).

Die theoretischen Annahmen, dass der Einsatz von Lernstrategien die Emotionen von Lernenden beeinflusst und umgekehrt die Emotionen von Lernenden deren Einsatz von Lernstrategien beeinflussen (Pekrun, 2006; Pekrun & Perry, 2014), wurden bislang allerdings nicht adäquat empirisch überprüft. Beziehungen zwischen Emotionen und Lernstrategien wurden zudem bisher mehrheitlich anhand von interindividuellen Daten aus Querschnittstudien untersucht. Aus diesen Studien können jedoch keine Aussagen zu Wirkrichtungen zwischen den Konstrukten abgeleitet werden. Ein Anliegen dieser Arbeit besteht darin, zum Schließen dieser Forschungslücke beizutragen.

In bisherigen Studien zum Zusammenhang zwischen Lern- und Leistungsemotionen und Lernstrategien wurde zumeist allein die Häufigkeit des Einsatzes von Lernstrategien erfasst (z. B. Artino & Jones, 2012, Chatzistamatiou, Dermitzaki, Efklides, & Leondari, 2015; King & Areepattamannil, 2014; Mega, Ronconi, & de Beni, 2014; Muis, Pekrun et al., 2015; Pekrun et al., 2002; Pekrun et al., 2011; Ranellucci, Hall, & Goetz, 2015; Stewart, Seifert, & Rolheiser, 2014). Dies ist problematisch, da Forschungen zeigen, dass Lernende zwar oft angeben, Lernstrategien häufig zu nutzen, dies jedoch nicht damit übereinstimmt, wie gut sie Lernstrategien tatsächlich einsetzen (Artelt, 2000). Dabei ist es nicht ausreichend, dass Lernende Lernstrategien nur anwenden. Neben dem deklarativen Wissen, dass es verschiedene Lernstrategien gibt, ist es wichtig, dass Lernende auch über das prozedurale Wissen verfügen, Lernstrategien kompetent anzuwenden (Weinstein, Acee, & Jung, 2011). Lernende, die hauptsächlich deklaratives Wissen zu Lernstrategien besitzen, jedoch nur über mangelndes prozedurales Wissen zur kompetenten Anwendung von Lernstrategien verfügen, können Probleme bei der Anwendung von Lernstrategien haben und diese falsch anwenden. Statt mehr Kontrolle über ihren Lernprozess zu erleben, kann dies dazu führen, dass sie so noch weniger Kontrolle über ihren Lernprozess erleben. Neben negativen Effekten auf den Lernprozess hat dies den theoretischen Annahmen der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) zufolge auch Auswirkungen auf das Erleben

von Emotionen. Um Wirkrichtungen zwischen Lernstrategien und Emotionen zu erforschen, ist es daher wichtig, zu erfassen, ob die Lernenden Lernstrategien tatsächlich kompetent anwenden. In der vorliegenden Arbeit wird daher ein Schwerpunkt auf der Berücksichtigung des kompetenten Einsatzes von Lernstrategien liegen.

Trotz der hohen Bedeutung von Lernstrategien für einen effektiven Lernprozess (z. B. de Boer et al., 2018; Donker et al., 2014; Hattie et al., 1996; Murayama et al., 2013) setzen Lernende Lernstrategien nicht zwangsläufig von selbst ein. Forschungsergebnisse zeigen, dass nur etwa ein Drittel der Lernenden einen selbstregulierten Zugang zum Lernen und dem Einsatz von Lernstrategien präferiert (Sontag et al., 2012). Die anderen Lernenden präferieren einen external regulierten Zugang, bei dem Eltern oder Lehrkräfte den Einsatz von Lernstrategien planen und steuern, oder einen impulsiven Zugang, bei dem Lernende ihren Lernprozess beginnen, ohne vorher über geeignete Lernstrategien nachzudenken (Sontag et al., 2012). Während eine naheliegende Erklärung darin liegt, dass der selbstregulierte Einsatz von Lernstrategien im Unterricht möglicherweise nicht genügend vermittelt wird, können auch die Emotionen der Lernenden eine Rolle spielen. Demnach könnten Emotionen nicht nur mit dem Lernverhalten (Pekrun & Linnenbrink-Garcia, 2014) in Verbindung stehen, sondern womöglich sind sie auch mit der Präferenz für einen selbstregulierten, external regulierten oder impulsiven Zugang zum Lernen verknüpft. Forschungsarbeiten hierzu stehen bisher jedoch noch aus, ebenso fehlen Studien dazu, wie sich Emotionen und eine Präferenz für einen selbstregulierten Zugang zum Lernen letztlich darauf auswirken, wie kompetent Lernende Lernstrategien einsetzen. Die vorliegende Arbeit soll dazu beitragen, die diesbezügliche Forschungslücke zu schließen.

Während der kompetente Einsatz von Lernstrategien und günstiges emotionales Erleben mit einem erfolgreichen Lernprozess und guten Leistungen in Verbindung stehen (z. B. Dent & Koenka, 2016; Putwain, Becker, Symes, & Pekrun, 2018), werden mangelnde Kompetenz beim Einsatz von Lernstrategien und ungünstiges emotionales Erleben gemeinsam mit ungünstiger Motivation als wichtige Faktoren für erwartungswidrige niedrige Leistungen bzw. Underachievement bei Lernenden gesehen (Reis & McCoach, 2000). Jedoch wird in den meisten Studien nur auf einen oder zwei dieser Aspekte fokussiert (z. B. Albaili, 2003; Kanevsky & Keighley, 2003; Laffoon, Jenkins-Friedman, & Tollefson, 1989). Darüber hinaus wird nur in sehr wenigen Studien zwischen verschiedenen Konstrukten differenziert, wenn die Ursachen für Underachievement untersucht werden (z. B. McCoach & Siegle, 2003). Eine gleichzeitige Berücksichtigung aller drei genannten Aspekte, bei der zwischen verschiedenen Konstrukten aus den Bereichen Lernstrategien, Emotionen und Motivation unterschieden wird, steht bisher noch aus. Ein Verständnis der Ursachen von

Underachievement sowie des Zusammenspieles dieser Ursachen ist wichtig, um effektive Interventionen zu entwickeln. Bisher existieren kaum Interventionsprogramme zur Unterstützung begabter Underachiever. Die Ergebnisse zur Wirksamkeit der wenigen Interventionen variieren (McCoach & Siegle, 2011). Ein Anliegen der vorliegenden Arbeit besteht deshalb darin, herauszufinden, ob und inwiefern der Einsatz von Lernstrategien, Emotionen und Motivation von Lernenden Underachievement prädizieren. Ein weiteres Anliegen besteht darin, zu überprüfen, ob eine Interventionsmaßnahme zur Verbesserung von Lernstrategien bei Underachievern auch positive (Neben-)Effekte auf deren Emotionen hat.

2 Ziele und Forschungsfragen

Das übergreifende Ziel dieser Arbeit bestand darin, die Zusammenhänge zwischen Emotionen sowie dem selbstregulierten und kompetenten Einsatz von Lernstrategien näher zu erforschen, um zum Schließen von bestehenden Forschungslücken beizutragen. Insgesamt wurden die im Folgenden ausgeführten fünf Ziele verfolgt.

Das erste Ziel dieser Arbeit bestand darin, Einblicke zu Wirkrichtungen zwischen Emotionen und dem Einsatz von Lernstrategien zu gewinnen (Ziel 1). Bisherige Studien zum Zusammenhang von Emotionen und dem Einsatz von Lernstrategien sind häufig Querschnittstudien, die keine Rückschlüsse auf Wirkrichtungen zulassen. Theoretischen Annahmen zufolge können einerseits Emotionen von Lernenden den Einsatz von Lernstrategien beeinflussen, andererseits kann der Einsatz von Lernstrategien die Emotionen der Lernenden beeinflussen (Pekrun, 2006; Pekrun & Perry, 2014). Experimentelle Studien stellen die einzige Möglichkeit dar, letztendlich gesicherte Erkenntnisse zu Kausalitätsbeziehungen zu erhalten. Die vorliegende Arbeit kann jedoch mit einem längsschnittlichen sequenziellen Studiendesign dazu beitragen, erste Erkenntnisse zu beiden theoretisch anzunehmenden Wirkrichtungen zu erlangen (Bolger & Laurenceau, 2013; Falkenström, Finkel, Sandell, Rubel, & Holmqvist, 2017). Emotionen und Lernstrategien werden dabei zeitlich nah aufeinander folgend in realen Lernsituationen über eine Vielzahl von Messzeitpunkten hinweg erfasst. Mit den in dieser Arbeit verwendeten Analysemethoden können zudem sowohl intraindividuelle Beziehungen, wie in der Kontroll-Wert-Theorie (Pekrun, 2006) postuliert, als auch interindividuelle Beziehungen, wie in bisherigen Querschnittstudien untersucht, betrachtet werden.

Das zweite Ziel bestand darin, einen Fokus auf den kompetenten Einsatz von Lernstrategien zu richten (Ziel 2). In bisher vorliegenden Studien zum Zusammenhang zwischen Emotionen und dem Einsatz von Lernstrategien wird zumeist die Häufigkeit des Lernstrategieeinsatzes gemessen. Der kompetente Einsatz von Lernstrategien ist jedoch von zentraler Bedeutung, denn nur wer Lernstrategien kompetent anwendet, kann letztlich Kontrolle über den eigenen Lernprozess gewinnen. Lernende, die hingegen Probleme beim kompetenten Einsatz von Lernstrategien haben, sollten wenig Kontrolle über ihren Lernprozess erleben. Der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) zufolge haben Unterschiede in der subjektiven Kontrolle der Lernenden Auswirkungen auf ihre Emotionen. Der kompetente Einsatz von Lernstrategien ist daher ein wichtiger Aspekt, der nicht vernachlässigt werden darf, wenn die Beziehung zwischen Emotionen und Lernstrategien erforscht wird.

Das dritte Ziel dieser Arbeit bestand darin, herauszufinden, inwieweit die Emotionen der Lernenden mit ihrer Präferenz für einen selbstregulierten Einsatz von Lernstrategien zusammenhängen und welchen Einfluss beide Aspekte darauf haben, wie kompetent Lernende Lernstrategien tatsächlich einsetzen (Ziel 3). Viele Lernende wenden Lernstrategien nicht von sich aus an. Statt eines selbstregulierten Zuganges zum Lernen präferieren Schülerinnen und Schüler häufig einen external regulierten Zugang zum Lernen, bei dem Lehrkräfte oder Eltern das Lernen planen und überwachen, oder sie präferieren es, impulsiv an das Lernen heranzugehen (Sontag et al., 2012). Ein möglicher Erklärungsfaktor können die Emotionen der Lernenden sein. Lernende, die beispielsweise wenig Freude beim Lernen empfinden, ziehen es womöglich vor, wenn Lehrkräfte oder Eltern ihren Lernprozess regulieren, oder präferieren es, impulsiv an das Lernen heranzugehen, ohne sich weiter Gedanken über das Lernen zu machen. Unterschiede in den Emotionen der Lernenden und ihrer Präferenz für einen selbstregulierten Zugang zum Lernen wirken sich möglicherweise gemeinsam darauf aus, wie kompetent Lernende Lernstrategien tatsächlich anwenden.

Das vierte Ziel dieser Arbeit bestand darin, differenziert und gleichzeitig zu untersuchen, inwieweit die beiden für einen erfolgreichen Lernprozess so wichtigen Aspekte – Emotionen und der (kompetente) Einsatz von Lernstrategien – gemeinsam mit der üblicherweise in Studien untersuchten geringen Motivation zur Vorhersage beitragen, ob Schülerinnen und Schüler hinter ihrem Leistungspotenzial zurückbleiben (Ziel 4). Emotionen und mangelnde Kompetenz beim Einsatz von Lernstrategien gelten neben der Motivation als wichtige individuelle Faktoren für das häufig untersuchte Phänomen Underachievement bei Lernenden (Reis & McCoach, 2000). Allerdings fehlte bisher eine Untersuchung, in der genau zwischen einzelnen Emotionen, Lernstrategien und motivationalen Konstrukten differenziert wird und gleichzeitig all diese Konstrukte als mögliche Prädiktoren für Underachievement miteinbezogen werden. Im Rahmen dieser Arbeit wird untersucht, welchen Erklärungsbeitrag Emotionen, der Einsatz von Lernstrategien sowie Motivation dazu leisten, vorherzusagen, ob Schülerinnen und Schüler zur Gruppe der Underachiever gehören, deren schulische Leistungen hinter ihrer kognitiven Leistungsfähigkeit zurückbleiben. Kenntnisse zu Ursachen von Underachievement helfen bei der Entwicklung gezielter Interventionsmaßnahmen.

Das fünfte Ziel dieser Arbeit war, zu überprüfen, ob aufgrund der Wechselwirkungen zwischen Emotionen und Lernstrategien eine gezielte Förderung eines kompetenten Einsatzes von Lernstrategien auch positive (Neben-)Effekte auf die Emotionen der Lernenden hat (Ziel 5). Spezielle Interventionsprogramme zur Unterstützung begabter

Underachiever sind selten und die Ergebnisse zu ihrer Wirksamkeit variieren (McCoach & Siegle, 2011). Interventionsprogramme zum selbstregulierten Lernen können nachweislich das Lernverhalten positiv beeinflussen (Dignath & Büttner, 2008). Da mangelnde Kompetenzen beim Einsatz von Lernstrategien als eine Ursache für Underachievement gelten (Reis & McCoach, 2000), erscheinen Interventionen zum selbstregulierten Lernen als geeignete Maßnahme zur Unterstützung von Underachievern. Aufgrund der in der Theorie (Pekrun, 2006; Pekrun & Perry, 2014) angenommenen und im Rahmen dieser Arbeit untersuchten Wechselwirkungen zwischen dem kompetenten Einsatz von Lernstrategien und Emotionen stellt sich die Frage, ob sich durch die gezielte Förderung eines kompetenten Einsatzes von Lernstrategien auch positive (Neben-)Effekte auf die Emotionen der Lernenden ergeben.

3 Überblick über die Artikel der vorliegenden Arbeit

Im Folgenden werden die drei Artikel vorgestellt, die in die kumulative Dissertation einfließen. Die Erkenntnisse aus diesen Artikeln tragen gemeinsam dazu bei, Forschungslücken zum Zusammenhang zwischen Emotionen und dem selbstregulierten und kompetenten Einsatz von Lernstrategien zu schließen.

3.1 Die Emotionen Freude und Langeweile bei Schülerinnen und Schülern und der Einsatz von kognitiven Lernstrategien – wie beeinflussen sie sich gegenseitig? (Artikel 1)

Artikel 1: Obergriesser, S., & Stoeger, H. (2020). Students' emotions of enjoyment and boredom and their use of cognitive learning strategies – How do they affect one another? *Learning and Instruction*, *66*, 101285. https://doi.org/10.1016/j.learninstruc.2019.101285.

Im ersten Artikel wurden Zusammenhänge zwischen Emotionen und dem Einsatz von Lernstrategien untersucht. Ein Ziel bestand darin, erste Einblicke zu Wirkrichtungen zwischen Emotionen und Lernstrategien zu gewinnen (Ziel 1). Dabei stand die Bedeutung eines kompetenten Einsatzes von Lernstrategien im Fokus (Ziel 2). Während es sich bei vorhergehenden Studien zum Zusammenhang von Emotionen und dem Einsatz von Lernstrategien häufig um Querschnittstudien handelte, die keine Rückschlüsse auf Wirkrichtungen zulassen, wurde in dieser Studie ein längsschnittliches, sequenzielles Design zugrunde gelegt, mit dessen Hilfe eine erste Ableitung kausaler Beziehungen möglich war (Falkenström et al., 2017). Mit dieser Methode konnten sowohl intraindividuelle Beziehungen, wie in der Kontroll-Wert-Theorie (Pekrun, 2006) postuliert, als auch interindividuelle Beziehungen, wie in bisherigen Querschnittstudien untersucht, betrachtet werden. Um Einblicke zu den Wirkrichtungen zwischen Emotionen und dem Einsatz von Lernstrategien zu erlangen, ist die Berücksichtigung eines kompetenten Einsatzes besonders wichtig. Allein die Anwendungshäufigkeit von Lernstrategien zu untersuchen, ist nicht ausreichend. Je nachdem, ob eine Lernende oder ein Lernender in der Lage ist, Lernstrategien kompetent einzusetzen, oder ob sie bzw. er Probleme bei ihrem Einsatz hat, sollten sich aufgrund von Unterschieden in den Kontroll-Appraisals unterschiedliche Auswirkungen auf Emotionen ergeben (Buff, 2014; Niculescu et al., 2016). In der Studie standen die Emotionen Freude und Langeweile im Fokus. Bei ihnen handelt es sich um häufig auftretende Emotionen im Lernkontext (Goetz et al., 2007; Nett, Goetz, & Hall, 2011; Pekrun et al., 2002), die zwei verschiedene Dimensionen von Valenz und

Aktivierungsgrad abbilden und von denen anzunehmen ist, dass sie mit dem Einsatz von Lernstrategien zusammenhängen. Der Einsatz von Lernstrategien wurde anhand von Textreduktionsstrategien untersucht, die als kognitive Organisationsstrategien beispielhaft für basale tiefenverarbeitende Informationsverarbeitungsstrategien stehen. Die kompetente Nutzung dieser Strategien ist Teil des Lehrplanes in Bayern (Bayerisches Staatsministerium für Unterricht und Kultus, 2014) und eine wichtige Basis für das Lernen aus Texten (z. B. Lonka, Lindblom-YlÄnne, & Maury, 1994). Auf der Basis theoretischer Überlegungen zur Kontroll-Wert-Theorie und Emotionen (Pekrun, 2006; Pekrun & Perry, 2014; Seligman & Csikszentmihalyi, 2000) sowie bisheriger Studien (z. B. Ahmed, van der Werf, Kuyper, & Minnaert, 2013; Artino & Jones, 2012; Chatzistamatiou et al., 2015; Pekrun et al., 2011; Tze, Daniels, & Klassen, 2016) gingen wir davon aus, dass Freude von Schülerinnen und Schülern den kompetenten Einsatz von Lernstrategien positiv beeinflusst, wohingegen Langeweile den kompetenten Einsatz von Lernstrategien negativ beeinflusst. Im Hinblick auf die entgegengesetzte Wirkrichtung nahmen wir an, dass der kompetente Einsatz von Lernstrategien nachfolgend erlebte Freude fördern und Langeweile reduzieren kann.

An der Studie nahmen 338 Schülerinnen und Schüler der vierten Jahrgangsstufe teil, die aus 18 Klassen an 17 Schulen stammten. Sie bearbeiteten über 25 Tage hinweg jeden Tag einen Sachtext, der jeweils zehn Hauptaussagen enthielt. Die Schülerinnen und Schüler wurden gebeten, während der Textbearbeitung kognitive Textreduktionsstrategien zu nutzen, um möglichst viele der im Text enthaltenen Hauptaussagen zu finden. Zur Auswahl standen das Unterstreichen und Herausschreiben von Hauptaussagen, das Erstellen einer Mindmap oder das Schreiben einer Zusammenfassung. Als Maß für den kompetenten Einsatz der Lernstrategien galt die Anzahl der richtig identifizierten Hauptaussagen. Freude und Langeweile wurden jeweils in der Lernsituation vor der Bearbeitung des Sachtextes gemessen. Single-Item-Skalen zu jeder Emotion befanden sich auf den Arbeitsblättern für die Aufgabenbearbeitung. Wie kompetent sie die Lernstrategien genutzt hatten, wurde den Schülerinnen und Schülern jeden Tag rückgemeldet, bevor sie mit der Bearbeitung des neuen Sachtextes begannen. So konnten die Emotionen der Schülerinnen und Schüler und der kompetente Einsatz von Lernstrategien zeitlich nah aufeinanderfolgend über einen längeren Zeitraum in realen Lernsituationen gemessen werden. Um sicherzustellen, dass die Untersuchungsergebnisse keine Artefakte der Beziehung zwischen Emotionen und Leistung darstellten, wurde der Notendurchschnitt der Schülerinnen und Schüler in den Hauptfächern Deutsch, Mathematik und Heimat- und Sachunterricht von den Lehrkräften erfragt und als

Kontrollvariable in die Berechnungen mit aufgenommen. Eine weitere Kontrollvariable war das Geschlecht der Schülerinnen und Schüler.

Die Datenstruktur enthielt Freude, Langeweile und den kompetenten Einsatz von Lernstrategien zu 25 Messzeitpunkten (Level-1) von Schülerinnen und Schüler (Level-2) aus verschiedenen Klassen (Level-3). Vorausgehende Analysen zeigten jedoch, dass die zusätzliche Aufnahme einer dritten Ebene nicht nötig war. Zur Modellierung der intra- und interpersonellen Unterschiede in der Zwei-Ebenen-Struktur verwendeten wir das „lme4"-Paket (Bates, Mächler, Bolker, & Walker, 2015) der Statistiksoftware „R" (R Development Core Team, 2015). Ein linearer Trend wurde als Kovariate im Linear-mixed-effects-Modell (Falkenström et al., 2017; Hilbert, Stadler, Lindl, Naumann, & Bühner, 2019) aufgenommen, um zu testen, ob ein allgemeiner Trend über die 25 Messzeitpunkte vorlag. Die längsschnittlichen Messungen von Emotionen und dem kompetenten Einsatz von Lernstrategien fanden jeweils zeitlich aufeinanderfolgend statt, wobei je nach Wirkrichtung die Ursache so modelliert wurde, dass sie dem Effekt vorausging. Zwar sind nur Experimente geeignet, gesicherte Ergebnisse über Kausalbeziehungen abzuleiten, aber durch das längsschnittliche, sequenzielle Design in Verbindung mit dem in der Analyse enthaltenen linearen Trend konnten erste Einsichten zu den Wirkrichtungen zwischen Emotionen und dem kompetenten Einsatz von Lernstrategien gewonnen werden (Falkenström et al., 2017; Finkel, 1995). Um intrapersonelle Einflüsse, wie in der Kontroll-Wert-Theorie postuliert (Pekrun, 2006), von interpersonellen Unterschieden, wie in zahlreichen Querschnittstudien erfasst, zu trennen, wurden die Werte der Emotionen und des kompetenten Einsatzes von kognitiven Lernstrategien in Level-1- und Level-2-Variablen disaggregiert (Wang & Maxwell, 2015): Die Variablen wurden am Personen-Mittelwert zentriert, um Variablen zu erhalten, die die intrapersonelle Veränderung der Emotionen und des kompetenten Einsatzes von kognitiven Lernstrategien über die Messungen hinweg repräsentieren (Level-1). Zu allen am Personen-Mittelwert zentrierten Variablen wurde eine zweite Variable hinzugefügt, die den Mittelwert einer Person bezüglich der jeweiligen Emotion bzw. des kompetenten Einsatzes von kognitiven Lernstrategien repräsentiert und so den interpersonellen Effekt (Level-2) abbildet. Um die Beziehungen zwischen den Emotionen Freude und Langeweile untereinander zu kontrollieren, wurde bei der Frage nach der Beeinflussung der nachfolgenden Emotionen durch den kompetenten Einsatz von kognitiven Lernstrategien diejenige Emotion, die nicht als abhängige Variable diente, als Kontrollvariable mit in das Modell aufgenommen.

Wird der Einfluss von Emotionen auf den kompetenten Einsatz von Lernstrategien betrachtet, so zeigte sich in den Ergebnissen, dass Freude, jedoch nicht Langeweile, den kompetenten Einsatz nachfolgender Lernstrategien beeinflusste. Ein intraindividueller Anstieg von Freude hatte einen positiven Effekt auf den kompetenten Einsatz der Lernstrategien. Dies bestätigte unsere Annahme auf der Basis der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) hinsichtlich der Emotion Freude. Im Gegensatz zu Freude war Langeweile auf intraindividuellem Level kein signifikanter Prädiktor für den kompetenten Einsatz der Lernstrategien. Ob Lernende zu Beginn der Textbearbeitung mehr oder weniger gelangweilt waren, hatte keinen Einfluss darauf, wie kompetent sie Lernstrategien anwandten. Unsere Annahme bestätigte sich hier nicht.

Bei Betrachtung der entgegengesetzten Wirkrichtung zeigte sich zunächst kein Einfluss des kompetenten Einsatzes von Lernstrategien auf Emotionen. Weder Freude noch Langeweile wurde durch den kompetenten Einsatz von Lernstrategien auf intraindividuellem Level vorhergesagt. Unsere Annahmen bestätigten sich nicht. Ob Lernende sich bei einer Aufgabe mehr oder weniger kompetent im Einsatz von Lernstrategien zeigten, hatte keinen Einfluss darauf, wie viel Freude oder Langeweile sie nachfolgend erlebten, wenn sie eine neue, ähnliche Aufgabe begannen.

Die Ergebnisse der interindividuellen Analyse, die mit jenen der bisherigen Querschnittstudien vergleichbar sind und keine Hinweise auf die Wirkrichtungen geben, unterschieden sich von den Ergebnissen der intraindividuellen Analyse. Interindividuelle Freude stand hier nicht im Zusammenhang mit dem kompetenten Einsatz von Lernstrategien. Lernende, die durchschnittlich mehr Freude als andere Lernende erlebten, wandten Lernstrategien nicht kompetenter an. Im Gegensatz dazu zeigte sich Langeweile im interindividuellen Vergleich als negativer Prädiktor für den kompetenten Einsatz von Lernstrategien. Jene Lernenden, die durchschnittlich mehr Langeweile erlebten, wandten Lernstrategien weniger kompetent an.

Im zeitlichen Verlauf zeigten sich signifikante Effekte für den kompetenten Einsatz von Lernstrategien und für Langeweile. Während Lernende Lernstrategien über die Messzeitpunkte hinweg immer kompetenter anwandten, nahm Langeweile im Laufe der Zeit ab. In Verbindung mit den Ergebnissen zu Langeweile aus den interpersonellen Analysen kann dies als ein Hinweis für einen dennoch bestehenden Zusammenhang zwischen Langeweile und dem kompetenten Einsatz von Lernstrategien gewertet werden, der sich jedoch in den intrapersonellen Analysen zu den Wirkrichtungen nicht zeigte und demnach weiter erforscht werden müsste.

3.2 Der Einfluss von Emotionen und Lernpräferenzen auf die Lernstrategienutzung von Schülerinnen und Schülern vor dem Übertritt an das Gymnasium (Artikel 2)

Artikel 2: Obergriesser, S., & Stoeger, H. (2016). The influence of emotions and learning preferences on learning strategy use before transition into high-achiever track secondary school. *High Ability Studies, 27*, 5-38. https://doi.org/10.1080/13598139.2015.1100980.

Im Artikel 1 zeigte sich, dass die Emotionen von Lernenden den kompetenten Einsatz von Lernstrategien beeinflussen können. Wie wichtig ein selbstregulierter Einsatz von Lernstrategien für einen erfolgreichen Lernprozess ist, wurde in zahlreichen Studien belegt (z. B. Donker et al., 2014). Jedoch scheinen Lernende es nicht unbedingt zu präferieren, Lernstrategien tatsächlich selbstreguliert einzusetzen (Sontag et al., 2012). Es stellt sich die Frage, inwieweit die Präferenz für einen selbstregulierten Einsatz von Lernstrategien mit den Emotionen von Lernenden zusammenhängt. Unklar ist auch, welchen Einfluss beide Aspekte darauf haben, wie kompetent Lernende Lernstrategien tatsächlich einsetzen (Ziel 3).

Im Laufe der Schulzeit nimmt die Anzahl an Hausaufgaben und Tests zu, ihre Schwierigkeit steigt und die Fähigkeit, selbstreguliert zu lernen, wird mehr und mehr vorausgesetzt (Cooper, Lindsay, Nye, & Greathouse, 1998; Zimmerman & Kitsantas, 2005). Die Emotionen der Lernenden verändern sich ebenfalls. So nehmen positive Emotionen wie Freude in dieser Zeit ab, während negative Emotionen wie Langeweile und Ärger zunehmen (Pekrun et al., 2006; Vierhaus, Lohaus, & Wild, 2016). Diese Veränderungen sind besonders nach dem Übergang vom Primar- in den Sekundarbereich zu beobachten (Vierhaus et al., 2016). Nach dem Übergang von der Grundschule an das Gymnasium steigen die Anforderungen oft besonders stark. Aus diesem Grund wurden in unserer Stichprobe die Emotionen und das Lernverhalten von 200 Schülerinnen und Schülern untersucht, die eine Empfehlung zum Übertritt an das Gymnasium erhalten hatten.

Analog zu vorausgegangenen Befunden (Sontag et al., 2012) nahmen wir an, dass Lernende es nicht präferieren würden, Lernstrategien selbstreguliert einzusetzen. Da Befunde zum Zusammenhang zwischen Emotionen und der Präferenz für den selbstregulierten Einsatz von Lernstrategien bisher noch ausstanden, nahmen wir an, dass sich die Beziehungen zwischen beiden Konstrukten ähnlich verhalten sollten wie jene zwischen Emotionen und dem Einsatz von Lernstrategien. So erwarteten wir auf der Basis der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) sowie der bisherigen Befunde zur Beziehung zwischen Emotionen und dem Einsatz von Lernstrategien (z. B. Artino & Jones, 2012; Pekrun et al., 2002), dass Lernende, die einen selbstregulierten

Zugang zum Lernen präferierten, mehr Freude und weniger Langeweile, weniger Ärger und weniger Angst erleben sollten als Lernende, die einen external regulierten oder impulsiven Zugang zum Lernen präferierten. Wir nahmen des Weiteren an, dass sich eine hohe Präferenz für selbstreguliertes Lernen gemeinsam mit einem hohen Maß an Freude bzw. einem niedrigen Maß an Langeweile, Ärger oder Angst positiv auf die kompetente Anwendung von Lernstrategien auswirken sollte.

Die Emotionen der Lernenden wurden mit einer adaptierten Version des traitspezifischen Fragebogens zu Lern- und Leistungsemotionen von Pekrun und Kollegen (2011) erhoben. Ebenfalls mithilfe eines Fragebogens wurde erfasst, ob die Lernenden präferiert Lernstrategien selbstreguliert oder external reguliert einsetzten oder ob sie lieber impulsiv an das Lernen herangingen, ohne über den Einsatz von Lernstrategien nachzudenken (Ziegler, Stoeger, & Grassinger, 2010). Um herauszufinden, wie kompetent die Lernenden Lernstrategien einsetzen, bearbeiteten sie an fünf aufeinanderfolgenden Tagen jeweils einen Text, der zehn Hauptaussagen enthielt. Diese sollten sie mithilfe von Lernstrategien finden. Wie kompetent Lernende kognitive Textreduktionsstrategien anwandten, wurde durch die Zählung der tatsächlich identifizierten Hauptaussagen erfasst. Um zu messen, wie kompetent Lernende darin waren, sich geeignete Ziele zu setzen, wurden sie gebeten, sich vor der Textbearbeitung zu überlegen, wie viele der in jedem Text enthaltenen zehn Hauptaussagen sie durchschnittlich richtig identifizieren wollten (metakognitive Lernstrategie Ziele setzen).

Mithilfe eines Chi-Quadrat-Tests wurde ermittelt, ob sich die deskriptiven Unterschiede zwischen der Präferenz für den selbstregulierten Einsatz von Lernstrategien, der Präferenz für den external regulierten Einsatz von Lernstrategien und der Präferenz für impulsives Lernen ohne den bewussten Einsatz von Lernstrategien als statistisch signifikant erwiesen. Ob Lernende mit verschiedenen Präferenzen sich auch in ihren Emotionen Freude, Langeweile, Ärger und Angst unterschieden, wurde mithilfe einer multivariaten Varianzanalyse überprüft. Das Ergebnis zeigte, dass die Mehrheit der Schülerinnen und Schüler in dieser Studie, die eine Übertrittsempfehlung für das Gymnasium erhalten hatten, keine Präferenz für den selbstregulierten Einsatz von Lernstrategien über einen external regulierten oder impulsiven Zugang zum Lernen aufwiesen. Lernstrategien selbstreguliert einzusetzen, präferierten 33 % der Schülerinnen und Schüler, 18,5 % von ihnen präferierten einen external regulierten Zugang zum Lernen und 46,5 % von ihnen präferierten es, impulsiv an das Lernen heranzugehen. Bei 2 % der Lernenden zeigte sich keine klare Präferenz. Die fehlende Präferenz eines selbstregulierten Zuganges zum Lernen über die anderen Zugänge zum Lernen entspricht vorhergehenden Ergebnissen (Sontag et al., 2012).

Die Präferenz eines selbstregulierten, external regulierten bzw. impulsiven Zuganges zum Lernen stand in einem signifikanten Zusammenhang mit ihren Emotionen Freude und Langeweile. Schülerinnen und Schüler, die einen selbstregulierten Zugang zum Lernen präferierten, gaben an, mehr Freude und weniger Langeweile zu erleben als jene Schülerinnen und Schüler, die einen external regulierten oder einen impulsiven Zugang zum Lernen präferierten. Für die Emotionen Ärger und Angst zeigten sich keine Unterschiede zwischen den Präferenzen für einen selbstregulierten, external regulierten oder impulsiven Zugang zum Lernen.

Um zu untersuchen, ob die Präferenz für den selbstregulierten Zugang zum Lernen in Kombination mit den erlebten Emotionen vorhersagte, wie kompetent Lernende Textreduktionsstrategien (kognitive Organisationsstrategien) anwandten und wie kompetent sie beim Setzen von Zielen waren (metakognitive Lernstrategie), wurde eine Serie von simultanen multiplen Regressionsanalysen durchgeführt. Signifikante Interaktionseffekte wurden mithilfe des SPSS Makros PROCESS (http://www.afhayes.com; Hayes, 2013) berechnet. Die Ergebnisse zur kompetenten Anwendung von Textreduktionsstrategien entsprachen nicht unseren Annahmen. Es zeigte sich, dass jene Lernenden, die viel Freude erlebten und gleichzeitig eine hohe Präferenz für den selbstregulierten Einsatz von Lernstrategien aufwiesen, Textreduktionsstrategien weniger kompetent anwandten, als jene Lernenden, die genauso viel Freude erlebten, aber den selbstregulierten Einsatz von Lernstrategien deutlich weniger präferierten. Die Ergebnisse für die Emotionen Langeweile, Ärger und Angst waren ähnlich. Jene Lernenden, die wenig Langeweile bzw. wenig Ärger oder wenig Angst erlebten und deren Präferenz für einen selbstregulierten Einsatz von Lernstrategien hoch war, zeigten sich entgegen unseren Annahmen bei der Anwendung von kognitiven Textreduktionsstrategien weniger kompetent als jene Lernenden, deren Emotionen ebenso ausgeprägt waren, die aber den selbstregulierten Einsatz von Lernstrategien deutlich weniger präferierten. Nur für eine hohe Ausprägung von Angst zeigte sich, dass Lernende, die viel Angst erlebten und den selbstregulierten Einsatz von Lernstrategien in hohem Maß präferierten, kognitive Textreduktionsstrategien kompetenter anwandten als Lernende, die ebenfalls viel Angst erlebten, aber den selbstregulierten Einsatz von Lernstrategien deutlich weniger präferierten.

Bei der metakognitiven Strategie Ziele setzen waren die Ergebnisse konform zu unseren Erwartungen. Lernende, die viel Freude bzw. wenig Langeweile, wenig Ärger oder wenig Angst erlebten und den selbstregulierten Einsatz von Lernstrategien stark präferierten, waren kompetenter im Setzen von Zielen als jene Lernende, deren Emotionen vergleichbar waren,

die jedoch den selbstregulierten Einsatz von Lernstrategien deutlich weniger präferierten. Bei der Emotion Langeweile zeigte sich darüber hinaus, dass Lernende, die viel Langeweile erleben, weniger kompetent beim Setzen von Zielen sind, wenn sie den selbstregulierten Einsatz von Lernstrategien stark präferieren. Die unterschiedlichen Zusammenhänge von Emotionen und der Präferenz für selbstreguliertes Lernen mit der kompetenten Anwendung von kognitiven und metakognitiven Lernstrategien, die sich hier zeigten, sollten in weiteren Studien differenziert erforscht werden.

3.3 Die Bedeutung von Emotionen, Motivation und Lernverhalten für Underachievement und die Frage, welche Ergebnisse eine Fördermaßnahme zum Lernverhalten erzielen kann (Artikel 3)

Artikel 3: Obergriesser, S., & Stoeger, H. (2015). The role of emotions, motivation, and learning behavior in underachievement and results of an intervention. *High Ability Studies, 26,* 167-190. https://doi.org/10.1080/13598139.2015.1043003.

3.3.1 Studie 1

In den Artikeln 1 und 2 wurde gezeigt, dass Emotionen und der kompetente Einsatz von Lernstrategien zusammenhängen. In der Studie 1 von Artikel 3 wurde untersucht, welchen Beitrag Emotionen und der Einsatz von Lernstrategien zur Vorhersage leisten, ob Schülerinnen und Schüler hinter ihrem Leistungspotenzial zurückbleiben (Ziel 4). In der Literatur zu Underachievement werden negative Emotionen, wie Angst („the anxious underachiever“ Mandel & Marcus, 1996), Langeweile („the bored student“ Heacox, 1991) oder Ärger („the Rebel“ Heacox, 1991), häufig als Merkmale von Lernenden genannt, die hinter ihrem Leistungspotenzial zurückbleiben (Reis & McCoach, 2000). Ebenso wird von einem Fehlen von Freude in der Schule berichtet (Bennett-Rappell & Northcote, 2016). Als weiterer Risikofaktor für Underachievement zeigten sich Defizite beim selbstregulierten Einsatz von Lernstrategien (Baslanti & McCoach, 2000; McCoach & Siegle, 2003). Neben negativen Emotionen und Defiziten beim selbstregulierten Einsatz von Lernstrategien werden im Bereich individueller Faktoren für Underachievement oft Probleme bezüglich der Motivation genannt, beispielsweise geringes Selbstwirksamkeitserleben (Diaz, 1998) oder niedrige Lernzielorientierung (Payne, 2009). Eine differenzierte und gleichzeitige Untersuchung von Emotionen, dem selbstregulierten Einsatz von Lernstrategien und motivationalen Konstrukten als Prädiktoren für Underachievement stand bisher noch aus. In der Studie 1 von Artikel 3 wurde daher untersucht, inwieweit Emotionen und der Einsatz von Lernstrategien gemeinsam mit motivationalen Konstrukten einen Beitrag zur

Vorhersage leisten, ob Schülerinnen und Schüler hinter ihrem Leistungspotenzial zurückbleiben.

An der Studie nahmen 85 hochbegabte Schülerinnen und Schüler teil. Die als hochbegabt identifizierten Schülerinnen und Schüler hatten einen Punktwert im 90. Perzentil bei der Bearbeitung des Standard Progressive Matrices Tests (Heller, Kratzmeier, & Lengfelder, 1998) erzielt. 24 dieser Schülerinnen und Schüler wurden als Underachiever definiert, da ihr z-standardisierter Notendurchschnitt mindestens eine Standardabweichung unter ihrem z-standardisierten Punktwert im Matrizen-Test lag. Die anderen 61 Schülerinnen und Schüler mit adäquaten Leistungen wurden als Achiever definiert.

Zur Messung potenzieller Faktoren zur Vorhersage von Underachievement wurde ein Fragebogen verwendet. Die Emotionen Angst, Ärger, Langeweile und Freude wurden mit einer adaptierten Version des AEQ erfasst (Pekrun et al., 2011). Zur Messung des Selbstwirksamkeitserlebens kam eine Skala von Schwarzer und Jerusalem (1999) zum Einsatz, zur Erfassung der Lernzielorientierung diente eine Skala nach Midgley und Kollegen (1998). Während in den Artikeln 1 und 2 darauf fokussiert wurde, zu messen, wie kompetent Lernstrategien tatsächlich eingesetzt wurden, wurde in der Studie 1 von Artikel 3 erfragt, inwiefern Lernende zustimmten, üblicherweise im Schulunterricht vermittelte Textreduktionsstrategien (z. B. Unterstreichen und Herausschreiben, Erstellen von Mindmaps) bei der Arbeit mit Texten zu verwenden. Das Ziel bestand hier darin, schnell und ökonomisch zu erfragen, welche Lernstrategien sie eigenen Angaben zufolge häufig nutzten. In der Studie 2 von Artikel 3 wurde dann wieder der kompetente Einsatz von Lernstrategien in den Fokus gerückt. Um vorherzusagen, ob Schülerinnen und Schüler hinter ihrem Leistungspotenzial zurückblieben und zur Gruppe der Underachiever gehörten, wurden binäre logistische Regressionen mit den Emotionen Angst, Ärger, Langeweile und Freude sowie Selbstwirksamkeitserleben, Lernzielorientierung und Textreduktionsstrategien als Prädiktoren berechnet und gegen das Nullmodell ohne Prädiktoren getestet.

Angst, Selbstwirksamkeitserleben und der Einsatz von kognitiven Textreduktionsstrategien zeigten sich als signifikante Prädiktoren für Underachievement. Die Ergebnisse für Angst und Selbstwirksamkeit entsprachen dabei unseren Erwartungen: Angst war ein positiver Prädiktor für Underachievement, Selbstwirksamkeit ein negativer Prädiktor. Je mehr Angst und je weniger Selbstwirksamkeit eine Lernende oder ein Lernender berichtete, desto größer war die Wahrscheinlichkeit, dass sie oder er zur Gruppe der Underachiever gehörte. Das Ergebnis zum Einsatz kognitiver Textreduktionsstrategien

war auf den ersten Blick überraschend. Je mehr kognitive Textreduktionsstrategien eine Lernende oder ein Lernender angab einzusetzen, desto größer war die Wahrscheinlichkeit, dass sie oder er zur Gruppe der Underachiever gehörte. Dieses Ergebnis schien zunächst Forschungsergebnissen zu widersprechen, die nahelegen, dass der Einsatz von kognitiven Lernstrategien einen erfolgreichen Lernprozess begünstigt (z. B. Murayama et al., 2013; Pekrun et al., 2017). Das Ergebnis unserer Studie unterstrich jedoch, wie wichtig es ist, nicht nur mithilfe von Fragebögen zu erfragen, wie häufig Lernende Lernstrategien anwenden. Es ist vielmehr von zentraler Bedeutung zu berücksichtigen, wie kompetent die Lernstrategien angewendet werden. Im zweiten Schritt analysierten wir daher in unserer Studie Korrelationen zwischen der selbstberichteten Anwendungshäufigkeit von Lernstrategien und Leistungen in einem standardisierten Leseverständnistest (HAMLET 3-4 von Lehmann, Peek, & Poerschke, 2006). Wurden sowohl Achiever als auch Underachiever in die Analysen miteinbezogen, so ergab sich eine negative Korrelation; je mehr kognitive Lernstrategien die Lernenden angaben einzusetzen, desto schlechter war ihre Leistung. Jedoch unterschieden sich die Ergebnisse, wenn die Gruppe der Achiever getrennt von der Gruppe der Underachiever analysiert wurde. Wurde nur die Gruppe der Achiever betrachtet, so zeigte sich eine marginal signifikante positive Korrelation, was bisherige Forschungsergebnisse unterstützt, die davon ausgehen, dass der Einsatz von kognitiven Lernstrategien mit höherer Leistung einhergeht. Bei der Gruppe der Underachiever war die Korrelation hingegen signifikant negativ. Je mehr kognitive Lernstrategien Underachiever angaben einzusetzen, desto schlechter war ihre Leistung im standardisierten Test. Auf der Basis dieser Ergebnisse und bisheriger Forschungen zu Underachievement (z. B. Reis & McCoach, 2000) kann darauf geschlossen werden, dass Underachiever, obwohl sie berichteten, kognitive Lernstrategien häufig einzusetzen, nicht wussten, wie sie diese kompetent einsetzen konnten. Wie schon in den Artikeln 1 und 2 gezeigt wurde, scheinen Emotionen und der Einsatz von Lernstrategien eng verknüpft zu sein. In der Studie 1 von Artikel 3 zeigten sich Emotionen gemeinsam mit dem Einsatz von Lernstrategien neben Motivation als Faktoren, die zur Vorhersage beitragen können, ob Lernende hinter ihrem Leistungspotenzial zurückbleiben.

3.3.2 Studie 2

In der Studie 2 von Artikel 3 wurde überprüft, ob aufgrund der häufig nachgewiesenen Wechselwirkungen zwischen Emotionen und Lernstrategien eine gezielte Förderung eines kompetenten Einsatzes von Lernstrategien auch positive (Neben-)Effekte auf die Emotionen

der Lernenden hat (Ziel 5). Um Emotionen von Lernenden tatsächlich gezielt zu verändern, eignen sich in erster Linie Emotionstrainings (Fingerle, Röder, & Müller, 2017; Petermann, Petermann, & Nitkowski, 2016). Zur Verbesserung des Lernverhaltens und des kompetenten Einsatzes von Lernstrategien haben sich Trainingsprogramme zum selbstregulierten Lernen als wirksam erwiesen (Dignath & Büttner, 2008). Aufgrund der in der Theorie (Pekrun, 2006; Pekrun & Perry, 2014) angenommenen und im Rahmen dieser Arbeit untersuchten Wechselwirkungen zwischen dem kompetenten Einsatz von Lernstrategien und Emotionen stellte sich jedoch die Frage, ob die Förderung eines kompetenten Einsatzes von Lernstrategien auch positive (Neben-)Effekte auf die Emotionen der Lernenden hat.

In der Studie 1 von Artikel 3 hatte sich gezeigt, dass neben einem geringen Selbstwirksamkeitserleben ein erhöhtes Erleben der Emotion Angst und Probleme beim Einsatz kognitiver Textreduktionsstrategien die Wahrscheinlichkeit für Lernende erhöhten, zur Gruppe der Underachiever zu gehören. Zur gezielten Unterstützung von Underachievern gibt es nur wenige Interventionsmaßnahmen und die Wirksamkeit dieser Maßnahmen variiert stark (McCoach & Siegle, 2011). Ein Trainingsprogramm von Stöger und Ziegler (2008), das bereits positiv an regulären sowie hochbegabten Grundschülerinnen und Grundschülern evaluiert wurde und den selbstregulierten und kompetenten Einsatz von Lernstrategien nachweislich fördert (Sontag & Stoeger, 2015; Stoeger, Sontag, & Ziegler, 2014), erschien daher als geeignet, Underachiever darin zu unterstützen, Lernstrategien kompetenter anzuwenden. Mögliche (Neben-)Effekte auf das Erleben der Emotion Angst wurden im Rahmen der Trainingsdurchführung überprüft.

Das Trainingsprogramm umfasst die Vermittlung deklarativen und prozeduralen Wissens zum selbstregulierten Lernen anhand eines normativen Modells und zahlreicher Übungsgelegenheiten. Das normative Modell wurde von Ziegler und Stöger (2005) auf der Basis des Modells selbstregulierten Lernens nach Zimmerman (2000) entwickelt und ist mit seinen sieben leicht verständlichen Zyklusschritten hilfreich für junge Lernende. Die Zyklusschritte umfassen die Selbsteinschätzung eigener Fähigkeiten (Schritt 1), auf deren Basis Lernende sich angemessene Lernziele setzen (Schritt 2). Anschließend planen die Lernenden, mit welchen Lernstrategien sie diese erreichen möchten (Schritt 3). Während der Anwendung dieser Lernstrategien (Schritt 4) überwachen die Lernenden kontinuierlich ihren Lernprozess (Schritt 5) und passen ihre Lernstrategie gegebenenfalls an (Schritt 6). Abschließend bewerten sie ihr Lernergebnis und setzen es mit ihrem Lernverhalten in Beziehung (Schritt 7). Im Trainingsprogramm zum selbstregulierten Lernen mit Textstrategien (Stöger & Ziegler, 2008) werden kognitive Textreduktionsstrategien, wie das

Unterstreichen und Herausschreiben von Hauptaussagen, das Erstellen von Mindmaps oder das Schreiben von Zusammenfassungen, mit den im Lernzyklus enthaltenen metakognitiven Lernstrategien verbunden. Diese Kombination aus kognitiven und metakognitiven Aspekten hat sich in Metaanalysen als besonders geeignet zur Vermittlung selbstregulierten Lernens und zur Förderung eines kompetenten Lernstrategieeinsatzes am Ende der Grundschulzeit erwiesen (Dignath & Büttner, 2008) und zeigte sich auch in diesem Trainingsprogramm erfolgreich (Stoeger et al., 2014).

An der Trainingsmaßnahme nahmen 34 Klassen teil. In diesen Klassen waren $N = 85$ Schülerinnen und Schüler hochbegabt (vgl. Artikel 3 Studie 1); von ihnen waren $n = 24$ als Underachiever und $n = 61$ als Achiever identifiziert. 18 Klassen wurden der Interventionsgruppe und 16 Klassen der Kontrollgruppe zugeordnet, die regulären Unterricht erhielt. Dies resultierten $n = 14$ Underachiever und $n = 38$ Achiever in der Interventionsgruppe und $n = 10$ Underachiever und $n = 23$ Achiever in der Kontrollgruppe. Zum Messzeitpunkt 1 wurde ein Fragebogen bearbeitet, mit dessen Hilfe Prädiktoren für Underachievement erfasst wurden (vgl. Instrumente Artikel 3 Studie 1). Anschließend wurde die Trainingsmaßnahme zum selbstregulierten Lernen über eine Dauer von sieben Wochen täglich als Teil des regulären Unterrichts durchgeführt. Zur richtigen Umsetzung der Trainingsmaßnahme und zum Umgang mit dem Trainingsmaterial waren die Lehrkräfte zuvor in einer mehrtägigen Fortbildung geschult worden. Darüber hinaus gab es umfassende Handreichungen zum Unterrichtsablauf. Nach Abschluss der Trainingsmaßnahme zum Messzeitpunkt 2 wurde der Fragebogen erneut eingesetzt, um die Effekte der Trainingsmaßnahme auf die zum Messzeitpunkt 1 erfassten Prädiktoren von Underachievement zu messen. Um herauszufinden, wie kompetent die Lernenden Lernstrategien einsetzen, bearbeiteten die Lernenden täglich einen Text, der zehn Hauptaussagen enthielt. Diese sollten sie mithilfe der im Rahmen der Trainingsmaßnahme thematisierten kognitiven Textreduktionsstrategien finden. Wie kompetent Lernende die kognitiven Textreduktionsstrategien anwandten, wurde erfasst, indem die Anzahl der tatsächlich identifizierten Hauptaussagen gezählt wurde. Darüber hinaus bearbeiteten die Lernenden täglich ein Lerntagebuch, in dem sie selbst einschätzten, wie gut ihnen der Einsatz der kognitiven Textreduktionsstrategien bei der Textarbeit gelingen würde (metakognitive Lernstrategie Selbsteinschätzung), und in dem anschließend auch festgehalten wurde, wie gut sie die Textreduktionsstrategien tatsächlich angewandt hatten. Darüber hinaus bewerteten sie vor jeder Textarbeit ihr Erleben von Angst.

Um die Wirkung der Trainingsmaßnahme zu evaluieren, wurde zum einen die selbstberichtete Anwendungshäufigkeit kognitiver Lernstrategien mithilfe von Messwiederholungsvarianzanalysen auf der Basis der Fragebogendaten analysiert. Zum anderen wurden Veränderungen in der kompetenten Anwendung von Lernstrategien mithilfe von 2-Level-Längsschnitt-Modellen auf der Basis der täglich gewonnenen Daten zum Lernen analysiert. Mögliche Effekte der Trainingsmaßnahme auf die Emotion Angst wurden auf die gleiche Weise mithilfe von Messwiederholungsvarianzanalysen auf der Basis der Fragebogendaten und 2-Level-Längsschnitt-Modellen auf der Basis der täglich gewonnenen Daten zum Erleben von Angst berechnet. Die 2-Level-Längsschnitt-Modelle wurden mit der Software HLM 6.08 erstellt.

Wie erwartet, zeigten sich positive Effekte der Trainingsmaßnahme auf das Lernverhalten von Underachievern und Achievern. Während die mithilfe des Fragebogens gemessene selbstberichtete Anwendungshäufigkeit von kognitiven Textreduktionsstrategien in der Kontrollgruppe gleich blieb, stieg sie in der Trainingsgruppe sowohl bei Underachievern als auch bei Achievern signifikant an. Unterschiede zwischen Underachievern und Achievern waren dabei nicht feststellbar. In den Analysen zum kompetenten Einsatz von Lernstrategien bestätigte sich nochmals das Ergebnis aus der Studie 1 von Artikel 3: Underachiever hatten Probleme beim Einsatz von kognitiven Textreduktionsstrategien. Sie waren zu Beginn der Trainingsmaßnahme deutlich weniger kompetent beim Einsatz dieser Lernstrategien als Achiever. In den 2-Level-Langsschnitt-Modellen wurde auch ersichtlich, dass Underachiever und Achiever gleichermaßen von der Trainingsmaßnahme profitierten. Underachiever ebenso wie Achiever wandten kognitive Textreduktionsstrategien im Laufe des Trainings immer kompetenter an. Darüber hinaus wurden die Lernenden kompetenter darin, sich selbst richtig einzuschätzen (metakognitive Lernstrategie Selbsteinschätzung). Hier hatten sich zu Beginn der Trainingsmaßnahme keine Unterschiede in der kompetenten Strategieanwendung gezeigt und auch im Verlauf profitierten Underachiever und Achiever gleichermaßen.

Hinsichtlich der Emotion Angst zeigten sich keine Effekte durch die Trainingsmaßnahme, weder in den Messwiederholungsvarianzanalysen auf der Basis der Fragebogendaten noch in den 2-Level-Längsschnitt-Modellen auf der Basis der täglichen Abfrage zum Erleben von Angst. Auch wenn Underachiever ebenso wie Achiever nach Abschluss der Trainingsmaßnahme noch häufiger angaben, Lernstrategien zu nutzen, sie vor allem aber auch kompetenter in deren Nutzung waren, hatte dies keine Auswirkungen auf ihr Erleben von Angst. Der mangelnde Zusammenhang zwischen Verbesserungen beim

kompetenten Einsatz von Lernstrategien und dem Erleben der Emotion Angst könnte möglicherweise dadurch zu erklären sein, dass das Erleben von Angst bei den Lernenden in dieser Studie durchgängig als sehr gering einzustufen war. Vielleicht zeigen sich langfristige Zusammenhänge auch erst zu einem späteren Zeitpunkt. Künftige Studien müssten demnach über einen längeren Zeitraum geplant werden.

4 Resümee

In dieser Arbeit wurden Erkenntnisse zum Zusammenhang zwischen Emotionen und dem selbstregulierten und kompetenten Einsatz von Lernstrategien gewonnen. An dieser Stelle wird ein abschließendes Resümee gezogen. Dafür werden zuerst die zentralen Befunde im Hinblick auf die Ziele und Forschungsfragen zusammengefasst und interpretiert (4.1). Danach werden Schlussfolgerungen für die Schulpraxis abgeleitet (4.2), bevor letztendlich die Grenzen der Arbeit aufgezeigt und Vorschläge für zukünftige Forschungsarbeiten unterbreitet werden (4.3).

4.1 Interpretation und Einordnung der zentralen Befunde

In diesem Abschnitt werden die zentralen Befunde vor dem Hintergrund der Ziele und Fragestellungen der Arbeit interpretiert und eingeordnet.

4.1.1 Ziel 1: Wirkrichtungen zwischen Emotionen und dem kompetenten Einsatz von Lernstrategien

Im Rahmen der Arbeit konnten Erkenntnisse zu den Wirkrichtungen zwischen Emotionen und dem kompetenten Einsatz von Lernstrategien gewonnen werden (Ziel 1). Die Untersuchungen erfolgten am Beispiel der Emotionen Freude und Langeweile. Auf der Basis theoretischer Überlegungen zur Kontroll-Wert-Theorie und Emotionen (Pekrun, 2006; Pekrun & Perry, 2014; Seligman & Csikszentmihalyi, 2000) sowie bisheriger Studien (z. B. Ahmed et al., 2013; Artino & Jones, 2012; Chatzistamatiou et al., 2015; Pekrun et al., 2011; Tze et al., 2016) gingen wir davon aus, dass Freude von Schülerinnen und Schülern den kompetenten Einsatz von Lernstrategien positiv beeinflusst, wohingegen Langeweile den kompetenten Einsatz von Lernstrategien negativ beeinflusst. Im Hinblick auf die entgegengesetzte Wirkrichtung nahmen wir an, dass der kompetente Einsatz von Lernstrategien nachfolgend erlebte Freude fördern und Langeweile reduzieren kann.

Entsprechend unseren Annahmen wirkte sich Freude positiv auf den kompetenten Einsatz von Lernstrategien aus. Im Rahmen unserer intraindividuellen Analyse war Freude ein signifikant positiver Prädiktor für den kompetenten Einsatz von Lernstrategien. Je höher die Freude der Lernenden war, wenn sie mit der Aufgabe begannen, desto kompetenter setzten sie bei dieser Aufgabe kognitive Lernstrategien ein. Die Ergebnisse aus intraindividueller und interindividueller Analyse verdeutlichten, dass es nicht darum geht, mehr Freude als andere Lernende zu erleben. Wichtig und ausreichend ist stattdessen, dass eine Lernende

oder ein Lernender etwas mehr Freude erlebt, als sie oder er das üblicherweise verspürt, um Lernstrategien kompetenter anzuwenden.

Langeweile wirkte sich entgegen unseren Annahmen nicht direkt auf den kompetenten Einsatz von Lernstrategien aus. In unserer intraindividuellen Analyse zeigte sich die Langeweile, die eine Lernende oder ein Lernender erlebte, nicht ausschlaggebend dafür, wie kompetent sie oder er Lernstrategien einsetzte. Für diesen Befund können mehrere Erklärungen angeführt werden. Eine erste Erklärung könnte darin bestehen, dass in unserer Studie nicht genau zwischen Über- und Unterforderungslangeweile (z. B. Acee et al., 2010) unterschieden wurde. Ebenso wie bereits andere Forscher (z. B. Pekrun et al., 2010), die erwarteten, dass ihre Lernenden Langeweile aus Überforderung erleben würden, weil die Aufgaben, die sie ihnen stellten, herausfordernd waren, erwarteten wir, dass die Schülerinnen und Schüler in unseren Untersuchungen Überforderungslangeweile erleben würden, weil die Texte, die sie bearbeiten sollten, relativ schwer waren. Allerdings könnte es sein, dass einige Schülerinnen und Schüler sich langweilten, weil sie Lernstrategien bereits sehr kompetent einsetzen konnten. Unterforderungslangeweile könnte demnach die Effekte von Überforderungslangeweile ausgeglichen haben. Eine Post-hoc-Analyse der Daten legt jedoch nahe, dass die meisten Schülerinnen und Schüler Überforderungslangeweile erlebten. In der Post-hoc-Analyse war das Erleben von Langeweile der zehn Prozent der Lernenden, die Lernstrategien am wenigsten kompetent anwandten, dem Erleben von Langeweile der zehn Prozent der Lernenden, die Lernstrategien am kompetentesten anwandten, gegenübergestellt worden. Es zeigte sich, dass jene zehn Prozent der Lernenden, die Lernstrategien am wenigsten kompetent anwandten, mehr Langeweile erlebten, wohingegen die zehn Prozent der Lernenden, die Lernstrategien am kompetentesten anwandten, deutlich weniger Langeweile erlebten. Eine zweite Erklärung könnte darin bestehen, dass die Auswirkung von Langeweile auf den kompetenten Einsatz von Lernstrategie nicht sichtbar wurde, weil alle Schülerinnen und Schüler im Allgemeinen recht wenig Langeweile erlebten. Diese Erklärung ist jedoch weniger wahrscheinlich, da sich in unseren interindividuellen Analysen, die keine Rückschlüsse auf Wirkrichtungen zulassen, durchaus ein signifikant negativer Zusammenhang zwischen Langeweile und dem Einsatz von Lernstrategien zeigte. Schülerinnen und Schüler, die im Durchschnitt mehr Langeweile erlebten, setzten Lernstrategien weniger kompetent ein. Dieses Ergebnis steht im Einklang mit Ergebnissen aus Querschnittstudien zwischen Langeweile und der Anwendungshäufigkeit von Lernstrategien (z. B. Artino & Jones, 2012; Pekrun et al., 2002; Pekrun et al., 2011). Eine

dritte Erklärung könnte daher darin bestehen, dass gelegentliche Langeweile keine Auswirkungen auf den kompetenten Einsatz von Lernstrategien hat. Auch wenn Lernende manchmal gelangweilter sind, wenn sie mit der Arbeit an einer Aufgabe beginnen, könnte dies keinen Effekt darauf haben, wie kompetent sie Lernstrategien anwenden, da ihr Strategiewissen die reduzierten kognitiven Ressourcen, die zur Aufgabenbearbeitung zur Verfügung stehen, kompensieren kann. Nur wenn Lernende regelmäßig gelangweilt sind, könnte sich dies negativ auf den kompetenten Einsatz von Lernstrategien auswirken.

In der entgegengesetzten Wirkrichtung beeinflusste der kompetente Einsatz von Lernstrategien das Erleben von Freude und Langeweile nicht. Zumindest zeigte sich dies zunächst nicht in unseren Befunden. Wie kompetent Lernende Lernstrategien bei einer Aufgabe einsetzten, sagte nicht signifikant vorher, wie viel Freude und Langeweile sie nachfolgend erlebten, wenn sie eine ähnliche Aufgabe begannen. Eine Erklärung für diesen Befund, der entgegen unseren Annahmen lag, könnte darin bestehen, dass die Schülerinnen und Schüler den Aufgaben, die sie bearbeiten sollten und bei denen sie ihre Kompetenz zeigen konnten, nicht genug Wert beimaßen, als dass dies ihre Emotionen beeinflussen würde. Gemeinsam mit Kontroll-Appraisals sind Wert-Appraisals der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) zufolge ausschlaggebend für das Erleben von Emotionen beim Lernen. Da den Schülerinnen und Schülern mitgeteilt worden war, dass sie für die Aufgabenbearbeitung keine Noten bekommen würden, könnte der Wert der Aufgaben aus ihrer Sicht geringer gewesen sein. In zukünftigen Studien sollte daher sichergestellt werden, dass auch der Wert der Aufgabe erfasst wird.

Es gab dennoch Hinweise in unserer Untersuchung, dass der kompetente Einsatz von Lernstrategien das Erleben von Langeweile beeinflussen könnte. Während des Erhebungszeitraumes nahm der kompetente Einsatz von Lernstrategien zu, während gleichzeitig Langeweile signifikant abnahm. Wenn der kompetente Einsatz von Lernstrategien gar keine Auswirkungen auf das Erleben von Langeweile haben würde, wäre zu erwarten, dass Langeweile über die Zeit zunehmen würde, da die Lernenden so häufig die gleiche Aufgabenart bearbeiteten. Stattdessen lernten die Schülerinnen und Schüler dadurch, dass sie über mehrere Wochen hinweg Lernstrategien verwendet und Feedback zu ihrer Effektivität erhalten hatten, Lernstrategien kompetenter anzuwenden. Dies könnte sich positiv auf die Kontroll-Appraisals der Schülerinnen und Schüler ausgewirkt haben, wodurch sie immer weniger Langeweile aufgrund von Überforderung erlebt haben könnten. In der intraindividuellen Analyse war die Veränderung jedoch noch nicht sichtbar geworden. Weitere Studien sind nötig, um die Zusammenhänge genauer zu prüfen.

Zusammenfassend lässt sich feststellen, dass sich im Rahmen unserer Untersuchungen Freude positiv auf den kompetenten Einsatz von Lernstrategien auswirkte. Bei Langeweile ließen sich diese direkten Auswirkungen nicht feststellen. Es ist zu vermuten, dass gelegentliche Langeweile keine direkten Auswirkungen auf den kompetenten Einsatz von Lernstrategien hat, ein regelmäßiges erhöhtes Erleben von Langeweile könnte sich jedoch negativ auf den kompetenten Einsatz von Lernstrategien auswirken. In der entgegengesetzten Wirkrichtung ließen sich ebenfalls keine direkten Auswirkungen eines kompetenten Einsatzes von Lernstrategien auf das Erleben von Freude und Langeweile nachweisen. Allerdings gab es Hinweise darauf, dass Verbesserungen beim kompetenten Einsatz von Lernstrategien langfristig mit einem reduzierten Erleben von Langeweile einhergehen. Während in vorangegangenen Studien die Zusammenhänge zwischen Emotionen und dem Einsatz von Lernstrategien auf der Basis interindividueller Analysen beleuchtet wurden, wurden im Rahmen dieser Arbeit, entsprechend den Forderungen von Molenaar und Campbell (2009), Annahmen der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) auch anhand von intraindividuellen Analysen untersucht. Das sequenzielle Design der Studie und die gewählten Analysemethoden ließen es zu (Bolger & Laurenceau, 2013; Falkenström et al., 2017), dass erste Erkenntnisse zu Wirkrichtungen zwischen Emotionen und dem Einsatz von Lernstrategien gewonnen werden konnten.

4.1.2 Ziel 2: Berücksichtigung des kompetenten Einsatzes von Lernstrategien

Das zweite Ziel bestand darin, einen Fokus auf den kompetenten Einsatz von Lernstrategien zu richten (Ziel 2). In allen drei Artikeln und den darin enthaltenen Fragestellungen wurde der kompetente Einsatz von Lernstrategien berücksichtigt und in seinem Zusammenhang mit den Emotionen von Lernenden analysiert. Vor allem im Hinblick auf mögliche Auswirkungen des Lernstrategieeinsatzes auf die Emotionen der Lernenden erscheint die Berücksichtigung der Kompetenz bei der Anwendung von Lernstrategien wichtig. Das für die Emotionen ausschlaggebende Erleben subjektiver Kontrolle (Pekrun, 2006; Pekrun & Perry, 2014) ist vermutlich dann besonders hoch, wenn Lernende in der Lage sind, Lernstrategien kompetent anzuwenden, und sich nicht mit Problemen bei deren Einsatz konfrontiert sehen. Wird nur die Anwendungshäufigkeit von Lernstrategien erfasst, werden eventuelle Probleme beim Einsatz von Lernstrategien nicht erkannt. Negative Auswirkungen möglicher Anwendungsprobleme auf das Erleben subjektiver Kontrolle und in der Folge auf die Emotionen der Lernenden sind dann nicht mehr nachvollziehbar.

Eindrucksvoll zeigte sich die Bedeutung der Berücksichtigung des kompetenten Einsatzes von Lernstrategien im Hinblick auf die Identifikation von Risikofaktoren für Underachievement (Ziel 4). Die Betrachtung der Anwendungshäufigkeit von Lernstrategien würde bei unseren Ergebnissen den Schluss nahelegen, dass ein vermehrter Einsatz von Lernstrategien das Risiko von Lernenden erhöht, zur Gruppe der Underachiever zu gehören. Wurde jedoch berücksichtigt, wie kompetent Lernende Lernstrategien einsetzen, zeigte sich, dass ein kompetenter Einsatz von Lernstrategien stattdessen vermehrt bei Achievern beobachtet werden konnte. Eine ausführlichere Diskussion zum Beitrag des Lernstrategieeinsatzes in Verbindung mit Emotionen und Motivation zur Vorhersage von Underachievement bei Schülerinnen und Schülern ist im Kapitel 4.1.4 zu finden.

4.1.3 Ziel 3: Zusammenhänge zwischen Emotionen und der Präferenz für den selbstregulierten Einsatz von Lernstrategien und deren mögliche gemeinsame Auswirkungen auf den kompetenten Einsatz von Lernstrategien

Das dritte Ziel dieser Arbeit bestand darin, herauszufinden, inwieweit die Emotionen der Lernenden mit ihrer Präferenz für einen selbstregulierten Einsatz von Lernstrategien zusammenhängen und welchen Einfluss beide Aspekte darauf haben, wie kompetent Lernende Lernstrategien tatsächlich einsetzen (Ziel 3). Unseren Ergebnissen zufolge hängen die Emotionen der Lernenden mit der Präferenz für den selbstregulierten Einsatz von Lernstrategien zusammen. Ähnlich wie in vorausgegangenen Untersuchungen (Sontag et al., 2012) präferierte nur ein Drittel der Lernenden, Lernstrategien selbstreguliert einzusetzen. Diese Lernenden präferierten es, sich auf der Basis ihrer Selbsteinschätzung eigene Ziele zu setzen, die Strategien zur Erreichung dieser Ziele selbst zu planen, anzuwenden und zu überwachen, gegebenenfalls anzupassen und letztendlich Lernergebnis und Lernprozess selbst zu bewerten. Entsprechend unseren Erwartungen erlebten diese Lernenden signifikant mehr Freude und weniger Langeweile als Lernende, die einen external regulierten oder impulsiven Zugang zum Lernen präferierten. Aufgrund der aktivierenden Komponente, die der Emotion Freude zugeschrieben wird, und der deaktivierenden Komponente, die der Emotion Langeweile zugeschrieben wird (Pekrun, 2006; Pekrun & Perry, 2014), könnte angenommen werden, dass Lernende, denen das Lernen mehr Freude bereitet und die weniger gelangweilt sind, auch einen selbstregulierten Zugang bevorzugen, bei dem sie selbst aktiv sein müssen und die Regulierung ihres Lernstrategieeinsatzes nicht anderen überlassen oder dies sogar ganz weglassen. Gleichzeitig könnte ein selbstregulierter Zugang zum Lernen, bei dem Lernende aktiv über ihr Lernen bestimmen, Freude fördern und

Langeweile reduzieren. Unsere rein korrelativen Ergebnisse erlauben jedoch in keiner Weise die Herstellung von Kausalzusammenhängen.

Es konnte auch gezeigt werden, dass die Emotionen der Lernenden in Kombination mit der Präferenz für einen selbstregulierten Zugang zum Lernen im Zusammenhang mit dem kompetenten Einsatz von Lernstrategien stehen. Dieser Zusammenhang wurde sowohl bei kognitiven als auch bei metakognitiven Lernstrategien untersucht. Die Ergebnisse zeigten deutliche Unterschiede.

Beim Einsatz kognitiver Lernstrategien waren die Ergebnisse entgegen unseren Erwartungen. Statt der erwarteten höheren Kompetenz zeigte sich, dass Lernende, die viel Freude bzw. wenig Langeweile, wenig Ärger oder wenig Angst erlebten und gleichzeitig eine hohe Präferenz für einen selbstregulierten Zugang zum Lernen aufwiesen, weniger kompetent darin waren, kognitive Textreduktionstrategien anzuwenden. Für eine mögliche Erklärung muss der gesamte Prozess des selbstregulierten Lernens betrachtet werden. Es ist anzunehmen, dass Lernende, die einen selbstregulierten Zugang zum Lernen präferieren, den gesamten Lernprozess im Auge behalten müssen und dafür kognitive Ressourcen aufbrauchen (Winne, 2011). Lernende, die einen externalen Zugang zum Lernen präferieren und daher möglicherweise andere wichtige Prozesse wie die Einschätzung eigener Stärken und Schwächen oder die Planung geeigneter Strategien auslagern und ihren Eltern oder Lehrkräften überlassen, könnten sich stattdessen ganz auf die Anwendung der (von den außen vorgegebenen) kognitiven Strategien konzentrieren. Gerade in Anfangsphasen des Arbeitens mit Lernstrategien wie in der Grundschule, wo davon auszugehen ist, dass Lernende noch nicht über ausreichend prozeduralisiertes Lernstrategiewissen verfügen (Lehmann & Hasselhorn, 2009), kann dies wahrscheinlich dazu führen, dass diese Lernenden besser in der Anwendung der kognitiven Strategien sind als jene, die einen selbstregulierten Zugang zum Lernen präferieren und deren Emotionen vergleichbar ausgeprägt sind. Ähnliches gilt für Lernende, die es stärker präferieren, impulsiv an das Lernen heranzugehen. Auch sie verbrauchen wahrscheinlich keine kognitiven Ressourcen, um den gesamten Lernprozess im Auge zu behalten, und könnten sich demnach auf die Anwendung der kognitiven Lernstrategien konzentrieren.

Beim Einsatz metakognitiver Lernstrategien zeigten sich Vorteile für die Lernenden, die einen selbstregulierten Zugang zum Lernen stark präferierten. Statt die Planung und Regulierung von Lernprozessen auszulagern oder ganz wegzulassen, scheint es, als hätten diese Lernenden bereits Kompetenzen in der Anwendung metakognitiver Lernstrategien erworben. Die Ergebnisse entsprachen unseren Annahmen. Lernende, die viel Freude bzw.

wenig Langeweile, wenig Ärger und wenig Angst erlebten und gleichzeitig eine hohe Präferenz für einen selbstregulierten Zugang zum Lernen aufwiesen, waren auch kompetenter darin, sich selbst geeignete Lernziele zu setzen. Die Kombination aus einem hohen Maß an positiven Emotionen bzw. einem geringen Maß an negativen Emotionen mit einer hohen Präferenz für einen selbstregulierten Zugang zum Lernen steht hier in einem positiven Zusammenhang mit dem kompetenten Einsatz metakognitiver Lernstrategien. Metakognitive Lernstrategien stützen die Anwendung kognitiver Lernstrategien (Veenman et al., 2006). Langfristig ist daher zu erwarten, dass positive Emotionen und die Präferenz für einen selbstregulierten Zugang zum Lernen zu einer kompetenten Anwendung metakognitiver und kognitiver Lernstrategien führen und so einen erfolgreichen Lernprozess ermöglichen (de Boer et al., 2018).

Erlebten die Lernenden ein hohes Maß an Freude und ein geringes Maß an negativen Emotionen wie Langeweile, Ärger oder Angst, schien ein enger Zusammenhang zwischen der Präferenz für einen selbstregulierten Zugang zum Lernen und dem kompetenten Einsatz von Lernstrategien zu bestehen. Wurde hingegen wenig Freude und ein hohes Maß an negativen Emotionen erlebt, war der Zusammenhang zwischen der Präferenz für einen selbstregulierten Zugang zum Lernen und dem kompetenten Einsatz von Lernstrategien scheinbar schwächer. Für eine solche Konstellation der Emotionen zeigten sich keine Unterschiede mehr zwischen einer hohen oder einer niedrigen Präferenz für einen selbstregulierten Zugang zum Lernen im Hinblick auf den kompetenten Einsatz von Lernstrategien.

Nur die Emotion Angst bildet beim Einsatz kognitiver Lernstrategien eine Ausnahme, ebenso wie die Emotion Langeweile beim Einsatz metakognitiver Lernstrategien. Schülerinnen und Schüler, die mehr Angst erlebten als andere und gleichzeitig eine starke Präferenz für einen selbstregulierten Zugang zum Lernen hatten, waren kompetenter beim Einsatz kognitiver Lernstrategien. In gewisser Weise scheint hier eine hohe Präferenz für einen selbstregulierten Zugang zum Lernen negative Effekte von hoher Angst abzumildern. Während Angst mit Vermeidungsverhalten assoziiert wird (Bandura, 1977; Zeidner, 2014), könnte die Präferenz für selbstreguliertes Lernen Vermeidungstendenzen reduzieren, was sich wiederum positiv auf die Anwendung kognitiver Lernstrategien auswirken könnte.

Im Hinblick auf die Emotion Langeweile und den Einsatz metakognitiver Lernstrategien zeigte sich, dass Lernende, die viel Langeweile erlebten und gleichzeitig den selbstregulierten Zugang zum Lernen stark präferierten, weniger kompetent darin waren, sich geeignete Lernziele zu setzen. Man könnte annehmen, dass hier die negative Beziehung

zwischen Langeweile und Anstrengung (Jarvis & Seifert, 2002; Pekrun et al., 2010) zum Tragen kommt und mit selbstreguliertem Lernen interagiert. Wenn Lernende sich stark langweilen, könnten sie es auch vermeiden wollen, sich beim Lernen sehr anzustrengen. Präferieren sie es dann, sich ihre eigenen Ziele zu setzen, könnte das schließlich dazu führen, dass sie sich Lernziele setzen, die leicht und ohne Anstrengung erreicht werden können und die deshalb zu niedrig sind.

Auf der Basis unserer Ergebnisse konkrete Schlüsse zum Zusammenhang zwischen Emotionen der Lernenden und ihrer Präferenz für einen selbstregulierten Zugang zum Lernen zu ziehen, ist noch nicht möglich. Gleiches gilt für den Zusammenhang dieser beiden Aspekte mit dem kompetenten Einsatz von Lernstrategien. Dies ist die erste Studie, in deren Rahmen etwaige Zusammenhänge untersucht wurden. Weitere Studien sind nötig, um die Ergebnisse besser einordnen zu können.

4.1.4 Ziel 4: Beitrag von Emotionen und mangelnder Kompetenz beim Einsatz von Lernstrategien zur Vorhersage, ob Schülerinnen und Schüler hinter ihrem Leistungspotenzial zurückbleiben

Emotionen und der Einsatz von Lernstrategien leisten gemeinsam mit Motivation einen Beitrag zur Vorhersage, ob Schülerinnen und Schüler hinter ihrem Leistungspotenzial zurückbleiben (Ziel 4). Angst, der Einsatz kognitiver Textreduktionsstrategien und Selbstwirksamkeit zeigten sich als prädiktiv für Underachievement. Je mehr Angst und je weniger Selbstwirksamkeit Schülerinnen und Schüler erlebten, desto wahrscheinlicher war, dass sie hinter ihrem Leistungspotenzial zurückblieben. Beim Einsatz kognitiver Lernstrategien zeigte sich, dass Lernende, die angaben, kognitive Lernstrategien sehr häufig zu nutzen, sogar mit größerer Wahrscheinlichkeit zur Gruppe der Underachiever gehörten als andere, die dies weniger häufig taten.

Dieses Ergebnis zur Anwendung kognitiver Lernstrategien war auf den ersten Blick überraschend, fügte sich aber in unsere Befunde zur Präferenz für einen selbstregulierten Zugang zum Lernen aus Artikel 2 ein. Dort war deutlich geworden, dass die reine Präferenz für einen selbstregulierten Zugang zum Lernen in Kombination mit einer adaptiven emotionalen Lage (viel Freude, wenig Langeweile, Ärger oder Angst) nicht ausreichend ist, um Lernstrategien auch kompetent anzuwenden. In der Studie 1 von Artikel 3 zeigte sich, dass auch eine häufige Anwendung von kognitiven Lernstrategien nicht zwingend eine kompetente Anwendung kognitiver Lernstrategien bedeutet.

Je häufiger Lernende in der Studie 1 von Artikel 3 angaben, Textreduktionsstrategien einzusetzen, desto wahrscheinlicher waren sie Underachiever und blieben damit hinter ihrem Leistungspotenzial zurück. Die selbstberichtete Anwendungshäufigkeit von kognitiven Lernstrategien schien damit grundsätzlich in einem negativen Zusammenhang mit der Leistung der Lernenden zu stehen. Allerdings zeigte sich in einem Leistungstest, dass die Achiever die Lernstrategien scheinbar gewinnbringend einsetzen konnten, denn jene Achiever, die angaben, kognitive Textreduktionsstrategien einzusetzen, erzielten tendenziell bessere Leistungen. Underachiever hingegen profitierten nicht von ihrem Einsatz und erzielten schlechtere Leistungen, je häufiger sie angaben, Textreduktionsstrategien einzusetzen. In der Studie 2 von Artikel 3 zeigte sich, was in der Studie 1 von Artikel 3 schon deutlich geworden war: Underachiever waren weniger kompetent darin, kognitive Textreduktionsstrategien einzusetzen. Es wurde offenkundig, warum es so wichtig ist, den Fokus auf den kompetenten Einsatz von Lernstrategien zu richten (Ziel 2) und nicht nur auf die Anwendungshäufigkeit. Nur wer Lernstrategien kompetent anwendet, kann letztendlich auch von ihrem Einsatz profitieren. Haben Lernende jedoch Probleme bei der Anwendung von Lernstrategien, so kann sich deren Anwendung, wie in der Studie 1 von Artikel 3 dargelegt, sogar negativ auf ihre Leistung auswirken.

Lernende, die im Vergleich zu anderen schlechtere Leistungen erzielten und gleichzeitig angaben, mehr Lernstrategien zu nutzen, schienen zu wissen, dass es Lernstrategien gibt, die ihnen dabei helfen können, ihren Lernprozess zu verbessern. Allerdings schien dieses Wissen eher deklarativ zu sein. Rein deklaratives Wissen zu Lernstrategien reicht jedoch nicht aus, um Lernstrategien kompetent und letztlich effektiv anzuwenden. Die Anwendung von Lernstrategien muss eingeübt und ausreichend prozeduralisiert werden. Winne (2011) beschreibt dies als einen Prozess, bei dem deklaratives Wissen über eine Handlung, vorstellbar als eine Liste von Schritten, zunächst in schwache noch etwas ineffiziente Handlungen überführt werden muss. In diesem Stadium binden diese Handlungen noch sehr viele kognitive Ressourcen. Erst am Ende des Prozesses stehen letztendlich effiziente, automatisierte Handlungen. Dann wird von gefestigtem prozeduralem Wissen gesprochen. Dieser Prozess erfordert jedoch sehr viel Übung mit entsprechendem Feedback (Ericsson, Krampe, & Tesch-Römer, 1993).

Underachiever schienen in unserer Studie (Studie 1 von Artikel 3) ihr deklaratives Wissen über den Einsatz von Lernstrategien noch nicht in prozedurales Wissen überführt zu haben. Darüber hinaus erlebten Underachiever unseren Ergebnissen nach mehr Angst als Achiever. Dies entspricht bisheriger Literatur zu Underachievement und Angst (z. B. Vlahovic-Stetic,

Vidovic, & Arambasic, 1999). Forschungen zufolge beeinflusst das Erleben von Angst die für zahlreiche Lern- und Denkprozesse wichtige Speicherkapazität des Gedächtnisses (z. B. Eysenck, Derakshan, Santos, & Calvo, 2007). Dies könnte sich wiederum darin zeigen, dass Underachiever Lernstrategien weniger kompetent anwenden.

4.1.5 Ziel 5: Auswirkungen einer gezielten Förderung des selbstregulierten und kompetenten Einsatzes von Lernstrategien auf die Emotionen der Lernenden

Abschließend wurde überprüft, ob aufgrund der Wechselwirkungen zwischen Emotionen und Lernstrategien eine gezielte Förderung eines kompetenten Einsatzes von Lernstrategien auch positive (Neben-)Effekte auf die Emotionen der Lernenden hat (Ziel 5). Dies wurde anhand der Emotion Angst untersucht, da sich für diese Emotion zuvor (vgl. Ziel 4) neben mangelnder Kompetenz beim Einsatz von Lernstrategien und motivationalen Defiziten als Prädiktor dafür erwiesen hatte, dass Lernende hinter ihrem Leistungspotenzial zurückblieben. Angst war darüber hinaus neben mangelnden Kompetenzen im Lernverhalten (Baslanti & McCoach, 2006) auch in anderen Studien als möglicher Faktor für Underachievement diskutiert worden (z. B. Mandel & Marcus, 1996).

Angst wird der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) zufolge besonders dann erlebt, wenn die Lernenden dem Lernen einen hohen Wert beimessen und gleichzeitig wenig Kontrolle über das Lernen verspüren. Wir nahmen an, dass Schülerinnen und Schüler, wenn sie eine Trainingsmaßnahme zum selbstregulierten und kompetenten Einsatz von Lernstrategien erfolgreich absolvierten, letztlich mehr Kontrolle über ihren Lernprozess erleben würden und sich dies auch auf das Erleben von Angst auswirken würde. Lernende würden demnach im Laufe des Trainings bzw. nach Abschluss des Trainings etwas weniger Angst erleben.

In unseren Ergebnissen hatte die Förderung eines selbstregulierten und kompetenten Einsatzes von Lernstrategien jedoch keine Auswirkungen darauf, wie viel Angst Lernende erlebten (Studie 2 von Artikel 3). Dies kann daraus resultieren, dass die an der Studie teilnehmenden Schülerinnen und Schüler bereits vor Beginn der Trainingsmaßnahme recht wenig Angst erlebten. Aus diesem Grund könnte ein Abnehmen von Angst schwer zu messen gewesen sein. Zudem war die Trainingsmaßnahme nicht dafür entworfen worden, Angst zu reduzieren, sondern dafür das Lernverhalten der Schülerinnen und Schüler zu verbessern. Dies geschah auch wirkungsvoll. Während mithilfe der Trainingsmaßnahme bereits in anderen Studien (Sontag & Stoeger, 2015; Stoeger et al., 2014) das Lernverhalten von Schülerinnen und Schülern verbessert werden konnte, zeigt sich die

Trainingsmaßnahme in der vorliegenden Arbeit auch bei begabten Achievern und Underachievern effektiv. Beide Gruppen verbesserten sich darin, Lernstrategien selbstreguliert und kompetent einzusetzen. Sie gaben beide an, kognitive Textreduktionsstrategien vermehrt zu nutzen, wandten diese kognitiven Lernstrategien auch kompetenter an und wurden kompetenter darin, sich selbst einzuschätzen (metakognitive Lernstrategie Selbsteinschätzung).

Es ist möglich, dass sich Effekte auf das Erleben von Angst nicht sofort im Laufe der Trainingsmaßnahme oder direkt im Anschluss daran auswirken. Stattdessen kann es sein, dass sich die Förderung eines kompetenten und selbstregulierten Einsatzes von Lernstrategien erst nach einer längeren Zeit auf die Emotion auswirkt und die Angst dann abnimmt. Dies könnte der Fall sein, wenn das verbesserte Lernverhalten auch zu Leistungszunahmen geführt hat und die Schülerinnen und Schüler festgestellt haben, dass sie durch den selbstregulierten und kompetenten Einsatz von Lernstrategien ihren Lernprozess tatsächlich aktiv kontrollieren können (vgl. Pekrun, 2006; Weiner, 1985). Dies kann sich auch auf andere Lern- und Leistungsemotionen auswirken. Für diese Interpretation sprechen die Ergebnisse zur Wirkrichtung zwischen Emotionen und dem kompetenten Einsatz von Lernstrategien aus Artikel 1, die anhand der Emotionen Freude und Langeweile untersucht worden waren. Im Artikel 1 hatte sich eine kompetentere Anwendung von Lernstrategien nicht darauf ausgewirkt, dass Lernende mehr Freude oder weniger Langeweile erlebten. Allerdings gab es im Artikel 1 Hinweise darauf, dass Verbesserungen beim kompetenten Einsatz von Lernstrategien langfristig mit einem reduzierten Erleben der negativen Emotion Langeweile einhergingen. Ebenso wie die Emotion Angst geht Langeweile, wenn es sich um die im Schulkontext häufig erlebte Überforderungslangeweile handelt, mit geringem Kontrollerleben einher (Acee et al., 2011). In künftigen Studien sollte daher gezielt und langfristig untersucht werden, inwiefern sich ein verbessertes Lernverhalten nicht nur auf die Leistungen der Lernenden (Donker et al., 2014), sondern auch auf deren Emotionen auswirkt.

4.2 Schlussfolgerungen für die Schulpraxis

Aus den Ergebnissen der im Rahmen dieser Arbeit entstandenen Studien lassen sich unter Einbeziehung aktueller Fachliteratur Schlussfolgerungen und Empfehlungen für die Schulpraxis ableiten. Im Folgenden sollen sie näher dargestellt werden.

4.2.1 Berücksichtigung von Emotionen im Unterricht

Die Ergebnisse der vorliegenden Arbeit untermauern die theoretische Annahme, dass sich Lern- und Leistungsemotionen auf den selbstregulierten und kompetenten Einsatz von Lernstrategien auswirken. Die Bedeutung von Freude im Lernprozess soll hier besonders hervorgehoben werden. Unsere Ergebnisse zeigen, dass ein Lernender bereits dann Lernstrategien kompetenter einsetzt, wenn er mehr Freude als üblicherweise in Lernsituationen erlebt. Dabei ist es irrelevant, ob er durchschnittlich mehr oder weniger Freude im Vergleich zu anderen Lernenden erlebt. Für den Unterricht kann daraus abgeleitet werden, dass das Ziel nicht darin bestehen muss, dass alle Schülerinnen und Schüler ständig nur Freude erleben müssen, um ihren Lernprozess erfolgreich zu gestalten. Lernfreude dauerhaft zu fördern, ist ein Ziel guten Unterrichts. Es ist aber für Lehrkräfte auch wichtig zu wissen, dass sich bereits ein punktueller Anstieg von Freude bei den Schülerinnen und Schülern positiv auf ihren Lernstrategieeinsatz auswirken kann.

Freude wird besonders häufig erlebt, wenn Lernende Erfolgserlebnisse erzielen (Tulis & Ainley, 2011). Lehrkräfte sollten darauf hinwirken, dass Schülerinnen und Schüler ihre Lernerfolge auf adaptives Lernverhalten wie den (teilweise anstrengenden) Einsatz von Lernstrategien attribuieren. Anstrengung und der Einsatz von Lernstrategien tragen letztlich zu erfolgreichen Lernprozessen bei (de Boer et al., 2018; Donker et al., 2014; Xu, 2018), wodurch letztlich wieder Erfolgserlebnisse für Schülerinnen und Schüler möglich werden. So können positive Kreisläufe in Gang gesetzt werden, denn Lernende, die Freude erleben, sind auch eher bereit, sich anzustrengen (Luo, Ng, Lee, & Aye, 2011). Dies steht auch im Einklang mit unseren Ergebnissen, dass Lernende, die es präferierten, sich anzustrengen und Lernstrategien selbstreguliert einzusetzen, mehr Freude erlebten als jene Lernenden, die einen external regulierten oder impulsiven Zugang zum Lernen präferierten.

Neben der Emotion Freude steht auch die Emotion Langeweile in Verbindung mit der Präferenz für den selbstregulierten Einsatz von Lernstrategien. Lernende, die einen selbstregulierten Zugang präferierten, erlebten weniger Langeweile als Lernende, die einen external regulierten oder impulsiven Zugang zum Lernen bevorzugten. Wenn es Lehrkräften beispielsweise durch die Attribution von Lernerfolgen auf den Einsatz von Lernstrategien gelingt, ihre Schülerinnen und Schüler mehr dafür zu begeistern, Lernstrategien anzuwenden, könnte dies möglicherweise auch das Erleben von Langeweile reduzieren.

Langeweile scheint den kompetenten Einsatz von Lernstrategien nicht direkt zu beeinflussen. Wenn Lernende im Unterricht in einzelnen Situationen etwas mehr Langeweile erleben, scheint sich dies nicht sofort negativ auf den kompetenten Einsatz von

Lernstrategien auszuwirken. Nur ein dauerhaft erhöhtes Erleben von Langeweile ging mit weniger kompetentem Einsatz von Lernstrategien einher. Für den Unterricht ist dies ein positives Ergebnis, denn Langeweile in jeglicher Situation bei den Lernenden zu vermeiden ist – trotz weitreichender Bemühungen zur Differenzierung – unrealistisch. Studienergebnisse zum Erleben von Langeweile schwanken zwischen 32 % der Unterrichtszeit (Larson & Richards, 1991) und 58 % der Unterrichtszeit (Nett et al., 2011), in der Langeweile erlebt wird. In Lern- und Leistungssituationen wird Langeweile häufiger erlebt als in anderen alltäglichen Situationen (Chin, Markey, Bhargava, Kassam, & Loewenstein, 2017).

Probleme treten auf, wenn Langeweile nicht nur punktuell, sondern dauerhaft erlebt wird. Um dies zu vermeiden, empfehlen beispielsweise Götz, Kranich, Roos und Gogol (2018) im Einklang mit der Kontroll-Wert-Theorie (Pekrun, 2006), den subjektiven Wert von Aufgaben für die Schülerinnen und Schüler zu erhöhen und das Interesse daran zu steigern, indem beispielsweise die Bedeutung der Lerninhalte im alltäglichen Leben der Schülerinnen und Schüler herausgearbeitet wird. Dies wird durch Befunde aus der Interessenforschung gestützt (z. B. Hulleman & Harackiewicz, 2009, Renninger & Hidi, 2016). Gute Klassenführung im Sinne eines effektiven Zeitmanagements und Regelklarheit können das Erleben von Langeweile gering halten, ebenso wie das Stellen kognitiv aktivierender, herausfordernder Aufgaben (Lazarides & Buchholz, 2019). Auch Lernende über hilfreiche Strategien im Umgang mit Langeweile zu informieren, kann nützlich sein (Götz et al., 2018). In den Studien zum Umgang mit Langeweile bei Schülerinnen und Schülern zeigte sich, dass vor allem jene Lernenden Langeweile reduzieren können und bessere Leistungen erzielen, die als sogenannte „Reappraisers“ versuchen, die jeweilige Lernsituation neu zu bewerten und sich selbst wiederholt die Wichtigkeit der Lerninhalte zu verdeutlichen (Nett, Goetz, & Daniels, 2010). Sogenannte „Evaders“, die versuchten, sich der Lernsituation bestmöglich zu entziehen, erleben hingegen am meisten Langeweile und erzielen schlechtere Leistungen (Nett et al., 2010).

Das Erleben der Emotion Angst hatte sich im Rahmen dieser Arbeit als wichtig im Zusammenhang mit Schülerinnen und Schülern gezeigt, die hinter ihrem Leistungspotenzial zurückbleiben. Angst scheint neben mangelnder Kompetenz beim Einsatz von Lernstrategien und motivationalen Defiziten ein Risikofaktor für Underachievement bei Schülerinnen und Schülern zu sein. Eine Trainingsmaßnahme zur Förderung eines selbstregulierten und kompetenten Einsatzes von Lernstrategien erzielte auf kurze Sicht zunächst keine Erfolge bei der Reduktion von Angst. Erhöhtes Kontrollerleben durch einen

kompetenteren Einsatz von Lernstrategien könnte aber auf längere Sicht Angst etwas reduzieren. Dies legen auch die Ergebnisse einer Metaanalyse zur Prüfungsangst nahe, der zufolge Prüfungsangst durch das Training von Lernstrategien reduziert wird (Ergene, 2003). Angst ist eine wichtige Emotion im Lernprozess und sollte nicht nur im Sinne von Prüfungsangst bei Schülerinnen und Schülern im Blick behalten werden. Lehrkräfte sollten versuchen, das Erleben von Angst im Lernprozess so gering wie möglich zu halten bzw. zu reduzieren. Eine Möglichkeit kann das Unterstützungsverhalten der Lehrkraft im Unterricht sein. Lernende, die viel Unterstützung durch eine Lehrkraft wahrnehmen, erleben weniger Angst (Lazarides & Buchholz, 2019). Weniger Angst wird auch dann erlebt, wenn eine positive Lehrer-Schüler-Beziehung vorherrscht (Mainhard, Oudman, Hornstra, Bosker, & Goetz, 2018) und Lehrkräfte darauf achten, dass die Unterrichtsstunden die Lernenden nicht überfordern. Überforderung in den Unterrichtsstunden, die beispielsweise durch einen Mangel an Struktur, schwierige Aufgaben, ein hohes Unterrichtstempo und hohe Erwartungen hervorgerufen werden kann, erhöht das Erleben von Angst im Unterricht (Goetz, Lüdtke, Nett, Keller, & Lipnevich, 2013) und sollte daher vermieden werden.

Die Emotion Ärger zeigte in der vorliegenden Arbeit den geringsten Zusammenhang mit den Lernstrategien von Schülerinnen und Schülern. In der Forschung steht Ärger meist in Verbindung mit ungünstigen Folgen für das Lernverhalten wie beispielsweise einem geringeren Einsatz von Lernstrategien (King & Areepattamannil, 2014; Pekrun et al., 2002; Pekrun et al., 2011) – wobei jedoch die Zusammenhänge nicht immer konsistent sind – und einem geringeren Erleben intrinsischer Motivation (Meyer & Gläser-Zikuda, 2020). Gleichzeitig wird jedoch auch angenommen, dass sich Ärger in manchen Fällen günstig auf das Lernverhalten auswirken kann. Beispielsweise dann, wenn er zu vermehrter Anstrengung führt, die aus extrinsischer Motivation zur Vermeidung von Misserfolgen resultiert (Pekrun et al., 2002). Es erscheint dennoch wichtig, das Erleben von Ärger im Lernprozess gering zu halten. Um dies zu erreichen, gelten ähnliche Empfehlungen wie für die Emotion Angst. Schülerinnen und Schüler sollten nicht durch einen Mangel an Struktur, überhöhte Erwartungen und zu schwierige Aufgaben überfordert werden (Goetz et al., 2013).

4.2.2 Stärkung des prozeduralen Lernstrategiewissens

Schülerinnen und Schülern den Einsatz von Lernstrategien zu vermitteln, ist zwar Teil alter und neuer Lehrpläne (Bayerisches Staatsministerium für Unterricht und Kultus, 2000, Bayerisches Staatsministerium für Unterricht und Kultus, 2014), dennoch präferieren es

Lernende nicht zwangsläufig, Lernstrategien tatsächlich auch selbstreguliert einzusetzen. Dies zeigte sich in vorangegangenen Studien (Sontag et al., 2012) ebenso wie in dieser Arbeit. Rabinowitz und Kolleginnen (1992) gehen davon aus, dass Lernende Lernstrategien häufig nicht einsetzen, obwohl sie wissen, dass sie effektiv sind, weil ihnen der Lernstrategieeinsatz keine Freude bereitet. Damit Schülerinnen und Schüler Lernstrategien tatsächlich effektiv nutzen, müssen sie neben dem Wissen um die Effektivität von Lernstrategien und dem deklarativen Wissen zum richtigen Einsatz von Lernstrategien auch ausreichend Gelegenheit erhalten, dieses Wissen zu prozeduralisieren. Erst dann sind Schülerinnen und Schüler in der Lage, Lernstrategien selbstreguliert und kompetent einzusetzen, was mit einem positiveren emotionalen Erleben in Verbindung steht.

Den selbstregulierten und kompetenten Einsatz von Lernstrategien zu prozeduralisieren, kann beispielsweise durch den Einsatz von Trainingsmaßnahmen im Unterricht erfolgen. Ein Trainingsprogramm, in dem der Fokus nicht nur auf dem Erwerb deklarativen Wissens zu Lernstrategien liegt, sondern auch das prozedurale Lernstrategiewissen gefestigt wird, ist das Trainingsprogramm zum selbstregulierten Lernen mit Textstrategien (Stöger & Ziegler, 2008). Darin schließt sich nach einer Phase der Vermittlung deklarativen Wissens zu kognitiven und metakognitiven Lernstrategien das intensive Einüben der neuen Strategien an. Geeignetes Feedback hilft den Lernenden dabei, ihren Strategieeinsatz kontinuierlich zu verbessern. Die Effektivität dieses Trainingsprogrammes wurde bereits mehrfach an verschiedenen Leistungsgruppen evaluiert (Sontag & Stoeger, 2015; Stoeger et al., 2014) und kam auch im Rahmen dieser Arbeit zum Einsatz, als Underachiever und Achiever erfolgreich darin gefördert wurden, Lernstrategien selbstreguliert und kompetent einzusetzen.

Im Unterricht bietet sich der Einsatz von Trainingsprogrammen zur Stärkung des prozeduralen Lernstrategiewissens aus verschiedenen Gründen an. Zum einen sind erfolgreich evaluierte Trainingsprogramme in der Regel so konzipiert, dass genügend Aufgaben zur Verfügung stehen, die Gelegenheit geben, das erworbene deklarative Wissen in prozedurales Wissen zu überführen (vgl. z. B. Gold, Mokhlesgerami, Rühl, Schreblowski, & Souvignier, 2006; Goldenstein et al., 2019). Zum anderen können Lehrkräfte, die bisher noch wenig Erfahrungen in der Förderung prozeduralen Lernstrategiewissens gesammelt haben, relativ sicher davon ausgehen, dass sie ihre Schülerinnen und Schüler in diesem Lernprozess erfolgreich unterstützen können. Aufbauend auf Erfahrungen mit bereits positiv evaluiertem Trainingsmaterial ist es anschließend leichter, auch selbst geeignetes Unterrichtsmaterial zu entwickeln.

Wie wichtig ein durch Prozeduralisierung erlangter selbstregulierter und kompetenter Einsatz von Lernstrategien im Allgemeinen ist, zeigen längsschnittliche Studien zum Zusammenhang mit Leistung (de Boer et al., 2018; Dent & Koenka, 2016). Die Förderung des Lernstrategieeinsatzes kann bereits im frühen Grundschulalter beginnen (Dignath, Buettner, & Langfeldt, 2008). Dadurch könnten auch negative Entwicklungsverläufe von Emotionen wie die Abnahme von Freude (Helmke, 1993; Vierhaus et al., 2016) im Verlauf der Schulzeit und die Zunahme von Langeweile im Lernprozess (Ahmed et al., 2013) gegebenenfalls abgemildert werden.

4.3 Limitationen und zukünftige Forschung

Im Rahmen der Arbeit wurden Wirkungszusammenhänge zwischen Lern- und Leistungsemotionen und dem Einsatz von Lernstrategien untersucht. Dies geschah anhand der Emotionen Freude und Langeweile sowie kognitiver Lernstrategien. Freude als positive aktivierende Emotion und Langeweile als negative deaktivierende Emotion gehören zu den häufigsten Emotionen, die in der Schule erlebt werden (Goetz et al., 2007; Pekrun et al., 2002). Dennoch gibt es zahlreiche andere Emotionen, die ebenso relevant für das Lernen sind und deren Zusammenhang mit dem Einsatz von Lernstrategien genauer untersucht werden sollte (z. B. Verwirrung, Frustration oder Stolz, vgl. D'Mello & Graesser, 2012; Pekrun & Stephens, 2012).

Neben dem Einsatz kognitiver Lernstrategien sind metakognitive Lernstrategien von Bedeutung. Es ist nicht ausreichend, allein kognitive Lernstrategien anzuwenden, um erfolgreich zu lernen. Der Einsatz metakognitiver Lernstrategien stellt sicher, dass diese Bemühungen auch erfolgreich sind. Besonders die Strategieüberwachung spielt dabei eine zentrale Rolle (Dent & Koenka, 2016). Um Wirkungszusammenhänge zwischen Emotionen und dem Einsatz von Lernstrategien noch besser zu verstehen, sollten daher auch metakognitive Lernstrategien verstärkt in den Fokus von Studien genommen werden, ebenso wie weitere Lern- und Leistungsemotionen.

Im Bestreben, Erkenntnisse über die Wirkungszusammenhänge zwischen Lern- und Leistungssituationen und den Einsatz von Lernstrategien zu gewinnen, wurde in dieser Arbeit ein sequenzielles längsschnittliches Design verwendet. Dies hilft allerdings nur dabei, erste Hinweise zu den Wirkrichtungen zu bekommen. Experimentelle Studien sind nötig, um gesicherte Kenntnisse zu Kausalzusammenhängen zu erlangen.

Den Annahmen der Kontroll-Wert-Theorie (Pekrun, 2006; Pekrun & Perry, 2014) folgend, wurde im Rahmen der vorliegenden Arbeit argumentiert, dass der selbstregulierte

und kompetente Einsatz von Lernstrategien mit der subjektiven Kontrolle der Lernenden und deshalb auch mit ihren Emotionen verbunden ist. Subjektive Kontrolle ist in der Forschungsliteratur als ausschlaggebend für das Erleben von Emotionen anerkannt (z. B. Buff, 2014; Goetz et al., 2010; Goetz & Hall, 2014). Dennoch kann es sinnvoll sein, in zukünftigen Studien Messungen subjektiver Kontrolle vorzunehmen, wie dies beispielsweise in der Studie von Muis, Psaradellis, Lajoie, Di Leo und Chevrier (2015) getan wurde.

Ein weiterer Punkt, der in künftigen Studien Berücksichtigung finden sollte, ist die Messung von Über- und Unterforderungslangeweile. Wie bereits erläutert, waren wir, analog zu anderen Studien (z. B. Pekrun et al., 2010), in dieser Arbeit davon ausgegangen, dass Lernende Überforderungslangeweile, aber keine Unterforderungslangeweile erleben würden, da die gestellten Aufgaben herausfordernd waren. In künftigen Studien sollte jedoch bei der Erhebung der Daten klar zwischen Überforderungslangeweile und Unterforderungslangeweile unterschieden werden. Das Erleben von Langeweile von besonders leistungsstarken oder -schwachen Lernenden kann dadurch besser erfasst werden.

Nicht zu vernachlässigen ist auch die Domänenspezifität von Lern- und Leistungsemotionen. Die Trait-Emotionen von Schülerinnen und Schülern unterscheiden sich entsprechend dem Fach bzw. der Domäne, in der sie erlebt werden. Für State-Emotionen ist diese Domänenspezifität weniger ausgeprägt (Goetz et al., 2014). In der im Rahmen dieser Arbeit durchgeführten Studie wurden die beiden Wirkrichtungen zwischen Emotionen und dem kompetenten Einsatz von Lernstrategien anhand der Messungen von State-Emotionen untersucht. Es kann also vermutet werden, dass diese Ergebnisse sich gut auf andere Domänen übertragen lassen. Die Auswirkungen einer gezielten Förderung eines selbstregulierten und kompetenten Einsatzes von Lernstrategien auf die Emotion Angst wurden sowohl anhand von State-Messungen im Lerntagebuch als auch von Trait-Messungen im Fragebogen untersucht. Die Ergebnisse unterschieden sich hier nicht. Der Zusammenhang zwischen Emotionen, der Präferenz für den selbstregulierten Einsatz von Lernstrategien und deren mögliche gemeinsame Auswirkungen auf den kompetenten Einsatz von Lernstrategien wurden jedoch rein anhand von Trait-Emotionsmessungen untersucht. Dies ist sinnvoll, da die Präferenz für den selbstregulierten Einsatz von Lernstrategien zeitlich relativ stabil ist und ebenso wie Trait-Emotionen weniger starken Schwankungen unterliegt. Inwieweit die Ergebnisse dieser Analysen auf Domänen außerhalb der Arbeit mit Texten übertragbar sind, sollte jedoch in künftigen Studien untersucht werden.

Im Hinblick auf State-Emotionen sollten in zukünftigen Studien auch Veränderungen von Emotionen während des Lernprozesses und des Einsatzes von Lernstrategien erforscht werden. Di Leo, Muis, Singh und Psaradellis (2019) beispielsweise erzielten erste Erkenntnisse zur Aufeinanderfolge epistemischer Emotionen wie Überraschung, Neugier und Verwirrung, die im Lernprozess besonders bei komplexen Lernaufgaben wie dem Lösen von Problemen auftreten. Ähnliche Studien sollten auch im Zusammenhang mit Lern- und Leistungsemotionen und dem selbstregulierten und kompetenten Einsatz von Lernstrategien angestrebt werden. So könnten weitergehende Erkenntnisse zu den Zusammenhängen zwischen beiden Konstrukten gewonnen werden, um sie letztendlich für die Schulpraxis nutzbar zu machen.

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Table of contents

Students' emotions of enjoyment and boredom and their use of cognitive learning strategies – how do they affect one another?

Abstract

To better understand the relationship between enjoyment and boredom and students' use of cognitive learning strategies, we analyzed both directions of effects between these constructs as described in the control-value theory of achievement emotions (Pekrun, 2006; 2018). Our study used a sequential design in which students' (N = 338 4th grade students) effective use of cognitive learning strategies was measured in real learning situations, allowing insights into the temporal order of effects and discrimination between intra- and interindividual effects (N = 8020 assessments within students). An increased intraindividual level of enjoyment positively predicted subsequent effective use of learning strategies, whereas effective use of learning strategies did not predict students' subsequent enjoyment on the intraindividual level. Interindividual differences in enjoyment and effective use of cognitive learning strategies were unrelated, whereas negative relations were found for boredom and effective strategy use. On the intraindividual level, boredom and effective strategy use were unrelated.

Keywords: enjoyment; boredom; cognitive learning strategies; intraindividual and interindividual differences

1. Introduction

Enjoyment and boredom are two of the most frequently experienced achievement emotions among learners (e.g. Larson & Richards, 1991; Pekrun, Goetz, Titz, & Perry, 2002). As both achievement emotions and the use of cognitive learning strategies are important for successful learning (Murayama, Pekrun, Lichtenfeld, & Vom Hofe, 2013; Pekrun, Lichtenfeld, Marsh, Murayama, & Goetz, 2017), a growing body of research has started to examine the relationship between these constructs. However, the exact relationship between students' emotions of enjoyment and boredom and use of cognitive learning strategies are not fully understood. In previous studies, enjoyment tends to show a positive link with students' use of cognitive learning strategies (e.g. Ahmed, van der Werf, Kuyper, & Minnaert, 2013; Chatzistamatiou, Dermitzaki, Efklides, & Leondari, 2015), whereas boredom shows a negative link (e.g. Artino & Jones, 2012; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). However, the results are partly inconsistent and the majority of studies is cross-sectional which does not allow for the fine-grained analysis necessary to understand the directions of effects. Sequential research is needed that makes it possible to examine whether students' enjoyment and boredom influence their use of cognitive learning strategies or whether students' use of cognitive learning strategies influences their enjoyment and boredom. According to the control-value theory of achievement emotions (Pekrun, 2006; Pekrun & Perry, 2014) both directions are possible.

The overall aim of this study was to understand the relationship between students' achievement emotions of enjoyment and boredom and their use of cognitive learning strategies better. To get an indication for the direction of effects between students' emotions and their use of cognitive learning strategies, we examine in a first step whether students' achievement emotions of enjoyment and boredom predict students' use of cognitive learning strategies at subsequent points in time. In a second step, we examine the opposite direction to assess whether students' use of learning strategies predicts subsequent enjoyment and boredom experienced when starting work on similar tasks.

1.1. Concepts of enjoyment, boredom and cognitive learning strategies

A theoretical framework that can be used to study enjoyment and boredom is the control-value theory of achievement emotions (Pekrun, 2006; Pekrun & Perry, 2014). Herein, perceptions of control and value are seen as antecedents to discrete emotions students

experience in learning and achievement related settings. These emotions are differentiated along the dimensions of valence (positive/negative), arousal (activating/deactivating) and object focus (activity/outcome). In learning contexts, enjoyment and boredom are two very frequently experienced emotions (e.g. Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007; Nett, Goetz, & Hall, 2011; Pekrun et al., 2002) which, representing two different dimensions of valence and arousal, are supposed to be interrelated with students' use of learning strategies and are therefore the focus of our study.

Enjoyment is a positive, activating emotion and is classified as an activity emotion (Pekrun, 2018). It is experienced when there is a match between an individual's personal goals and the learning task (Linnenbrink, 2007), provided the task is valued positively, and that the activity is perceived as sufficiently controllable (Pekrun, 2006). Perceived control is an essential antecedent of enjoyment (Goetz, Frenzel, Stoeger, & Hall, 2010), with positive changes in control leading to positive changes in enjoyment of learning (Buff, 2014).

Boredom is a negative, deactivating emotion that is also ranked as an activity emotion (Pekrun, 2018). Boredom is experienced when there is a divergence between an individual's personal goals and a given task, or when there are no specific goals, if a learning activity is neither valued positively nor negatively (Pekrun, 2011) and when perceived control is either too high or too low. According to Csikszentmihalyi (1975) boredom is experienced when an individual's capabilities are high compared to the task's demands, so that perceived control for the individual is high (i.e., under-challenging situations). However, in the control-value theory of achievement emotions (Pekrun, 2006) an additional relationship is postulated. Accordingly, boredom might also be experienced when there is a lack of control over the activity because demands exceed individual capabilities (i.e., in over-challenging situations). Several studies corroborate these assumptions (e.g. Acee et al., 2010; Goetz, Pekrun, Hall, & Haag, 2006; Pekrun et al., 2011; Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010). Research by Niculescu, Tempelaar, Dailey-Hebert, Segers, and Gijselaers (2016) suggests that the reduction of perceived control and value leads to an increase in boredom.

Cognitive learning strategies support the learner in processing information during direct interaction with the learning material. Metacognitive learning strategies help leaners to efficiently implement cognitive learning strategies (Flavell, 1979). In our study, we focus on cognitive learning strategies as basic strategies for knowledge acquisition. However, the importance of metacognitive strategies for the effective use of cognitive learning strategies needs to be kept in mind and will be referred to in the discussion section. Cognitive learning strategies include rehearsal strategies, organization strategies and elaboration strategies

(Weinstein, Husman, & Dierking, 2000). Rehearsal strategies involve the repetition of information. Organization strategies help students to select and organize relevant information and to establish connections among the different elements of the learning material as well as to create meaningful units of information. Elaboration strategies are used to connect new information with prior knowledge and thereby help integrate new units of information into the existing network of information. In reference to the level at which information is thought to be processed, rehearsal strategies are sometimes also called surface (level) learning strategies, while organization and elaboration strategies are called deep (level) learning strategies (cf. Marton & Säljö, 1976). Extensive research on the effectiveness of cognitive learning strategies (e.g. Hattie, Biggs & Purdie, 1996; Murayama et al., 2013; Nota, Soresi, & Zimmerman, 2004) has shown that the use of learning strategies helps students control their learning process and positively influence the outcome.

1.2. Previous research

1.2.1. Enjoyment and cognitive learning strategies

Most cross-sectional studies show a positive relationship between students' enjoyment and how often they reported applying cognitive learning strategies. When the different categories of cognitive learning strategies are examined separately, the results are not always consistent. There are studies that show positive links between the frequency of rehearsal strategy use and enjoyment among undergraduates (Pekrun et al., 2011; Muis, Pekrun, et al., 2015, study 1) and secondary school students (King & Areepattamannil, 2014). In other studies, however, no significant relationship between the frequency of rehearsal strategy use and enjoyment was found among undergraduate students (Muis, Pekrun, et al., 2015, study 2; Pekrun et al., 2002). The use of organization strategies was positively associated with enjoyment among secondary school students (King & Areepattamannil, 2014). Furthermore, the frequency of elaboration strategy use shows a positive link to enjoyment among undergraduate (Artino & Jones, 2012; Muis, Pekrun, et al., 2015, study 1 and 2; Pekrun et al., 2002; Pekrun et al., 2011) and secondary school students (King & Areepattamannil, 2014). Chatzistamatiou et al. (2015) found a positive relationship between 5th and 6th grade students' enjoyment and a combined cognitive strategies factor containing the frequency of rehearsal, organization and elaboration strategy usage. Di Leo, Muis, Singh, and Psaradellis (2019) obtained the same results with students in grades 5 and 6, using a combined factor of cognitive learning strategies in study 1. However, study 2 showed no connection between

enjoyment and cognitive learning strategies that followed the experience of enjoyment. In a study by Muis, Psaradellis, Lajoie, Di Leo, and Chevrier (2015) 5th grade students' enjoyment was not related to how often they applied surface strategies such as rehearsal strategies and deep strategies like organization and elaboration strategies.

Positive links between enjoyment and frequency of cognitive learning strategy use were also found in longitudinal studies. Ranelluci, Hall, and Goetz (2015) examined undergraduate students' enjoyment and how often they applied elaboration strategies over time. Enjoyment was a positive predictor of frequency of elaboration strategy use six months later. Ahmed et al. (2013) found that changes in the enjoyment experienced by seventh graders over one school year were consistently linked to changes in the use of cognitive strategies. The further enjoyment decreased among students, the less frequently they reported applying rehearsal, organization, and elaboration strategies.

1.2.2. Boredom and cognitive learning strategies

Results on the link between boredom and the use of cognitive learning strategies are rather inconsistent, though more often negative in cross-sectional studies. Pekrun et al. (2010, study 2) found a weak positive connection between undergraduate students' frequency of rehearsal strategy use and boredom. However, no significant relationships could be found in other studies, neither among undergraduate students (Muis, Pekrun, et al., 2015, study 2; Pekrun et al., 2002; Pekrun et al., 2010, study 3 and 4; Pekrun et al., 2011) nor among secondary school students (King & Areepattamannil, 2014). Muis, Pekrun, et al. (2015, study 1) in contrast, found negative links between boredom and frequency of rehearsal strategy use among undergraduates. The frequency of organization strategy use was not related to boredom among secondary school students (King & Areepattamannil, 2014). Furthermore, the correlation between boredom and frequency of elaboration strategy use in cross-sectional studies with undergraduate students is more often negative (Artino & Jones, 2012; Muis, Pekrun, et al., 2015 study 1 and 2; Pekrun et al., 2002; Pekrun et al., 2011) than non-significant (Artino, 2009). Among secondary school students it was found to be non-significant (King & Areepattamannil, 2014). Muis, Pekrun et al. (2015) and Muis, Psaradellis, et al. (2015) did not find links between 5th grade students' boredom and their use of surface strategies such as rehearsal strategies, but they found significant negative links between boredom and the frequency of use of deep learning strategies like organization and elaboration strategies. Di Leo et al. (2019) also found significant negative associations

between boredom and frequency of strategy use among 5th and 6th graders using a combined factor of cognitive learning strategies in study 1, while in study 2 no link emerged between boredom and any cognitive learning strategies that followed the experience of boredom.

In a longitudinal study, Ahmed et al. (2013) found a significant negative relation between frequency of rehearsal strategy use and boredom of secondary school students. To the best of our knowledge, no longitudinal study exists focusing on organization strategies alone; Ahmed et al. (2013), however, combined organization and elaboration strategies into one factor which did not show significant relations to students' boredom. In another longitudinal study, Ranellucci, Hall and Goetz (2015) found no relationship between undergraduate students' frequency of elaboration strategy use and boredom.

1.2.3. Conclusions from previous studies and theoretical considerations

The cross-sectional studies cited above support the assumption that students' emotions of enjoyment and boredom and their use of cognitive learning strategies are related. The relationships between enjoyment and the use of cognitive learning strategies are positive in most studies; findings on the relation between boredom and the use of cognitive learning strategies are inconsistent, albeit mostly negative. These results are partly consistent with theory: Enjoyment as a positive activating emotion should facilitate the use of learning strategies (Pekrun, 2006; Pekrun & Perry, 2014) as cognitive resources are preserved and attention can be focused on the task. Boredom as a negative deactivating emotion should, on the contrary, impede the use of cognitive learning strategies as cognitive resources and task attention are reduced (Pekrun, 2006; Pekrun & Perry, 2014).

In theory, however, the assumption is not only that the emotions enjoyment and boredom should affect the use of cognitive learning strategies, furthermore cognitive learning strategies are expected to influence the emotions of enjoyment and boredom. In accordance with the control-value theory of achievement emotions (Pekrun, 2006; Pekrun & Perry, 2014), research shows that positive changes in perceived control and value longitudinally predict increased enjoyment of learning and reduced boredom (Buff, 2014; Niculescu et al., 2016). Therefore, enhancing perceptions of personal control may be an effective way to foster enjoyment (cf. Goetz et al., 2010; Seligman & Csikszentmihalyi, 2000) and to reduce boredom due to over-challenging situations (Pekrun et al., 2010). Research has shown that perceived control can be enhanced through explicit training (Hall, Perry, Chipperfield, Clifton, & Haynes, 2006; Perry, Chipperfield, Hladkyj, Pekrun, &

Hamm, 2014). One way to increase perceived control in learning situations might be to apply adequate learning strategies. However, in order to increase control, it is not enough if students simply apply learning strategies, as they might struggle with a competent implementation and might not apply the strategies correctly, and thus feel even less in control of their learning process. Therefore, students also need to know whether they are applying learning strategies competently. To sum up, students who are able to apply learning strategies competently –and are aware of this– should perceive control over their learning process, which in turn should lead to increased enjoyment and decreased boredom due to over-challenging situations. This assumption is supported by D'Mello and Graesser's (2012) model of affective dynamics. This model assumes that when obstacles in the learning process are removed – for example by effectively using learning strategies – boredom is reduced and students enjoy their learning.

Several additions to existing research could be beneficial: First, a systematic examination of the relationship between use of learning strategies and the emotions of enjoyment and boredom is needed. Most of the existing studies have focused on the frequency of learning strategy use, instead of examining the effective use of learning strategies (i.e., how competently students apply learning strategies). This seems problematic as research shows that students often report applying cognitive learning strategies frequently but at the same time are not able to apply them competently (Obergriesser & Stoeger, 2015). This can affect students' perceived control and, consequently, their emotions (Buff, 2014; Niculescu et al., 2016). The effective use of learning strategies therefore is an important aspect that should not be neglected when looking at the relationship between emotions and use of learning strategies. To measure the effective use of cognitive learning strategies, measurements within real learning situations are indispensable. It is also important to measure students' emotions in real learning situations as they can change quickly (Ekman, 1994) and recall-based measures might be influenced by subjective beliefs (Robinson & Clore, 2002).

Second, previous research has predominantly assessed the relationship between students' emotions of enjoyment and boredom and their use of cognitive learning strategies using cross-sectional studies. From these studies, however, researchers cannot gather information about the direction of effects between the constructs. Theoretically the influence between students' emotions and their use of cognitive learning strategies can go in both directions (Pekrun, 2006; Pekrun & Perry, 2014). Although experimental research is the only way to draw firm causal conclusions, sequential studies with many subsequent

measurements in real learning situations would be helpful to gain first insights on the probable causal processes (Bolger & Laurenceau, 2013; Falkenström, Finkel, Sandell, Rubel, & Holmqvist, 2017) and to examine both directions of effects postulated in theory. There are two longitudinal studies on the relation between students' emotions and cognitive learning strategies (Ahmed et al., 2013; Ranellucci et al., 2015). However, both focused on the influence of emotions on the frequency of students' cognitive learning strategy use, measuring the constructs via questionnaires at three points in time during one school year of secondary school (Ahmed et al., 2013) and twice during the course of two semesters in university (Ranellucci et al., 2015). Although the studies provide insights into the relationship between the constructs, causal inferences cannot be made. To gain first insights into the temporal sequence of effects, emotions and cognitive learning strategies should be measured in close approximation within real learning situations over several subsequent points in time.

Third, although the control-value theory of achievement emotions (Pekrun, 2006) postulated intraindividual relationships, most studies use analyses that only allow the assessment of interindividual differences (cf. Molenaar & Campbell, 2009). Analysis methods which enable researchers to examine both intraindividual distributions within persons and interindividual distributions between persons simultaneously, in order to connect findings from intraindividual analyses to results from interindividual analyses, would be helpful.

1.3. The present study

The overall aim of this study was to better understand the relationship between students' enjoyment and boredom and their effective use of cognitive learning strategies. In particular, we were interested in the direction of effects between these constructs. As the influence can theoretically go in both directions (Pekrun, 2006; Pekrun & Perry, 2014), we examined whether students' enjoyment and boredom predict the effective use of their subsequent cognitive learning strategies and whether the effective use of students' cognitive learning strategies predicts their subsequent enjoyment and boredom. In our study we (a) measured students' effective use of text-reduction strategies (as one form of cognitive organization strategies[1]) instead of the frequency of use of these strategies. The measurement

[1] The effective use these strategies is included in the state curriculum for regular fourth-grade German instruction in Bavaria, where our study was conducted (Bayerisches

of emotions and strategy use (b) took place sequentially every day over several weeks in real learning situations. Furthermore, we (c) used a statistical approach (Falkenström et al., 2017; Wang & Maxwell, 2015) that made it possible to analyze intraindividual effects, which represent changes within persons and thus allows us to examine the temporal order of effects in sequential studies, and interindividual effects, which represent differences between persons and therefore allow careful comparisons to previous cross-sectional studies.

1.3.1. Do students' enjoyment and boredom influence the effective use of their subsequent cognitive learning strategies?

Previous studies show overall positive links between enjoyment and frequency of cognitive learning strategy use, and rather inconsistent, though more often negative, links between boredom and the frequency of cognitive learning strategy use (e.g. Ahmed et al., 2013; Chatzistamatiou et al., 2015; Tze, Daniels, & Klassen, 2016). As inconsistencies in these studies might be related to the effects of measuring how frequently students use learning strategies instead of how effectively they use them, we assume, in accordance with theoretical accounts (Pekrun, 2006; Pekrun & Perry, 2014), that students' enjoyment should positively influence the effective use of cognitive learning strategies, whereas students' boredom should negatively influence the effective use of cognitive learning strategies. Specifically, we expect *enjoyment* to positively predict the effective use of subsequent text-reduction strategies (1) and *boredom* to negatively predict the effective use of subsequent text-reduction strategies (2).

1.3.2. Does the effective use of students' cognitive learning strategies influence students' subsequent enjoyment and boredom?

Taking the results from previous studies on the frequency of learning strategy use and emotions into account and including the theoretical considerations that perceived control is an important antecedent of enjoyment and boredom (Buff, 2014; Goetz et al., 2010; Pekrun etal., 2010; Seligman & Csikszentmihalyi, 2000) which can be positively or negatively influenced by the effective use of learning strategies, we assume that an effective use of learning strategies should enhance enjoyment and reduce boredom. Specifically, we expect

Staatsministerium für Unterricht und Kultus, 2000) and is an important basis for eventually learning from texts (e.g. Lonka, Lindblom-YlÄnne, & Maury, 1994).

the effective use of text-reduction strategies to positively predict subsequent *enjoyment* (3) and to negatively predict subsequent *boredom* (4).

2. Method

2.1. Sample and procedure

The sample consisted of N = 338 fourth grade students from 18 classrooms in 17 different primary schools in southern Germany. Data collection was part of a larger investigation involving teachers, parents, and students (see Matthes & Stoeger, 2018). Entire classrooms of regular schools were recruited via the local education authorities. Approximately half (56.5%) of the students were female, students' mean age was 10.24 years (SD = 0.36). Participation was voluntary and parents gave their written consent.

Data collection was incorporated into regular classroom instruction. Over the course of 5 weeks, students worked on basic science texts (i.e. texts about aspects of everyday life, including topics from biology, geography, physics and health). Although belonging to a larger intervention study, the texts were based on the regular curriculum. Work on a text was part of students' regular school work every day of the week, resulting in a total of 25 texts. Each text contained ten main ideas which the students were asked to find. All texts included several distractor sentences in addition to the ten main ideas, were of comparable length (about 420 words) and difficulty and had already been tested in other studies (c.f. Stoeger, Sontag, & Ziegler, 2014). Prior to working on each text, students indicated their emotions of enjoyment and boredom with regard to working on the task in single-item scales on their worksheets. Emotions were measured at the beginning of the task to have an emotion measure unbiased of problems that students might encounter later during their work on the text. While working on the texts, students were asked to apply cognitive text-reduction strategies in order to find the ten main ideas included in the text. The text-reduction strategies they were asked to use were underlining the main ideas in the text and – as students often tend to underline a lot and do not make a clear decision – they should write down the main ideas on a separate page, either using little excerpts from the text or rephrasing them in their own words. Furthermore, they were allowed to draw mind maps containing the main ideas. Teachers were given the solutions for each text and were asked to check their students' work every day[2]. The correct main ideas of each text were discussed with the classmates and the

[2] Later at data entry, random samples were checked by research assistants, who could not find any inconsistencies in the scoring of the main ideas.

teacher the following day. Thereby students were informed about the effectiveness of their learning strategies (number of main ideas correctly found). Given our theoretical rationale that knowing about the effectiveness of one's strategy use should influence ones' control appraisals and thus ones' emotions when starting work on a new text, the following method was implemented: immediately after receiving feedback on the correctly identified main ideas in the previous text but before starting work on the subsequent text, students were asked to indicate their emotions with regard to working on the next text. This design made it possible to analyze students' emotions of enjoyment and boredom as well as their effective use of the cognitive learning strategies in close proximity: Students applied text-reduction strategies in one text, the following day they received information on the effectiveness of their text-reduction strategies, then indicated their enjoyment and boredom with regard to the new, similar learning task, and then instantly started work on this task.

2.2. Measures

Enjoyment and boredom

Enjoyment and boredom were measured in the specific learning situation prior to working on each text. A single-item scale for enjoyment and one for boredom was included on students' worksheets above the expository texts (Items: "Prior to working on the text I am happy."/ "Prior to working on the text I am bored.") with a six-point Likert scale ranging from 1 (completely disagree) to 6 (completely agree) as answer format.

Effective use of cognitive text-reduction strategies

To measure how competently students applied cognitive text-reduction strategies, they were asked to work through 25 expository texts from the domain of basic science and identify as many of the ten main ideas included in each text as possible. The number of correctly identified main ideas in each text indicated students' effective use of cognitive text-reduction strategies (between 0 and 10).

Academic achievement

To ensure that observations were not mere artefacts of the relation between students' emotions and their academic achievement (e.g. Pekrun et al., 2017; Putwain, Becker, Symes, & Pekrun, 2018), we controlled for students' grade point average (GPA) in German, mathematics and science as provided by the teachers. In Germany, the best possible grade is

1 while 5 and 6 indicate that the classroom goal was not reached. To facilitate interpretation, grades are scaled inversely so that 6 indicates greatest achievement.

Gender

As implied in the control-value theory of achievement emotions (Pekrun, 2018), students' emotions might differ with regard to gender. To control for possible differences, gender was included as a covariate in our analyses. Gender was coded 1 = *female*, 0 = *male*.

2.3. Data analysis

Students' task-specific emotions of enjoyment and boredom and effective use of the text-reduction strategies were collected over 25 days (Level 1) and were nested within individuals (Level 2). Individuals were further nested in classes (Level 3), but calculations of intra-class correlations from unconditional random effects models, as reported in the preliminary analyses, did not suggest including a third level into our analyses. To model both interindividual and intraindividual relationships in 2-Level-data, we used linear mixed effects modeling included in the "lme4" package (Bates, Mächler, Bolker, & Walker, 2015) of the software R (R Development Core Team, 2015). Linear mixed regression models were estimated to examine our assumptions.

The data structure included 25 measurement points of students' enjoyment, boredom and effective use of text-reduction strategies. As we included an autoregressive predictor for each outcome, this resulted in the inclusion of 24 measurements of the outcome variable in each analysis. To test for a common trend over the measurement days, a linear trend (coded: 0, 1, 2, 3,…, 23) was added as a covariate in the linear mixed effects model (Falkenström et al., 2017; Hilbert, Stadler, Lindl, Naumann, & Bühner, 2019).

The longitudinal measurements of emotions and effective use of learning strategies (and vice versa for assumptions three and four) follow each other in the temporal order of events, and cause was modeled to precede effects. Only an experimental study would be suited to derive firm causal relations. However, our time-lagged design, which includes a linear trend to limit the risk that the observed effect is confounded with irrelevant variables having a linear effect on the outcome variable over time, might give first insights into the direction of effects (Falkenström et al., 2017; Finkel, 1995).

To disentangle intraindividual and interindividual effects throughout the study, the values of emotions and effective use of text-reduction strategies were disaggregated into level-1- and level-2-variables as proposed by Wang and Maxwell (2015): person-mean-

centering was applied to obtain variables representing the intraindividual change of emotions and effective use of text-reduction strategies throughout the measurements (Level 1).To all person-mean-centered variables a second variable was created, containing the individual's mean value over all time points in the respective emotion and effective use of text-reduction strategies, representing the interindividual effect (Level 2). Separating the variance of these variables into time-series (Level 1) and cross-sectional-variance (Level 2) has been shown to strongly improve the quality of the analysis and the interpretability of the results (Falkenström et al., 2017; Wang & Maxwell, 2015). Furthermore, to control for associations between enjoyment and boredom in assumptions three and four, the emotion not serving as an outcome variable was included as a control variable both on the intraindividual and the interindividual level. The resulting models were:

Do students' enjoyment (1) and boredom (2) influence the effective use of their subsequent cognitive learning strategies?

$$\text{Effective use of strategies}_{ij} = \gamma_0 + \gamma_1 \text{Effective use of strategies}_{ij,(t-1)} + \gamma_2 (\text{Enjoyment}_{ij} - \overline{\text{Enjoyment}_j}) + \gamma_3 \overline{\text{Enjoyment}_j} + \gamma_4 (\text{Boredom}_{ij} - \overline{\text{Boredom}_j}) + \gamma_5 \overline{\text{Boredom}_j} + \gamma_6 \text{Academic Achievement}_j + \gamma_7 \text{Gender}_j + \gamma_8 (\text{Time}) + u_{0j} + u_{1j} + \varepsilon_{ij}$$

Does the effective use of students' cognitive learning strategies influence students' subsequent enjoyment (3) and boredom (4)?

$$\text{Enjoyment}_{ij} = \gamma_0 + \gamma_1 \text{Enjoyment}_{ij,(t-1)} + \gamma_2 (\text{Effective use of strategies}_{ij} - \overline{\text{Effective use of strategies}_j}) + \gamma_3 \overline{\text{Effective use of strategies}_j} + \gamma_4 (\text{Boredom}_{ij} - \overline{\text{Boredom}_j}) + \gamma_5 \overline{\text{Boredom}_j} + \gamma_6 \text{Academic Achievement}_j + \gamma_7 \text{Gender}_j + \gamma_8 (\text{Time}) + u_{0j} + u_{1j} + \varepsilon_{ij}$$

$$\text{Boredom}_{ij} = \gamma_0 + \gamma_1 \text{Boredom}_{ij,(t-1)} + \gamma_2 (\text{Effective use of strategies}_{ij} - \overline{\text{Effective use of strategies}_j}) + \gamma_3 \overline{\text{Effective use of strategies}_j} + \gamma_4 (\text{Enjoyment}_{ij} - \overline{\text{Enjoyment}_j}) + \gamma_5 \overline{\text{Enjoyment}_j} + \gamma_6 \text{Academic Achievement}_j + \gamma_7 \text{Gender}_j + \gamma_8 (\text{Time}) + u_{0j} + u_{1j} + \varepsilon_{ij}$$

The γ coefficients represent the mean regression weights, and i and j represent the intra- and interindividual indices, respectively. The random part of the intercepts is represented by u_{0j}, while u_{1j} represents the random effects of time (i.e., the variation among students around

the average linear trajectory). Individual residuals of the measurement points are represented by $\varepsilon_{ij.}$ The variable Time represents the linear trend. Equations within brackets represent the intraindividual effects of effective use of text-reduction strategies, enjoyment and boredom. The mean value over all time points of these variables represent the interindividual effects. Benjamini-Hochberg correction (Benjamini & Hochberg, 1995) was applied to all linear mixed effects models to account for the number of predictors in the analysis.

3. Results

3.1. Preliminary analyses

Table 1 provides the means, standard deviations and ranges for each variable. For the emotions of enjoyment and boredom as well as for the effective use of text-reduction strategies, the values are based on person-aggregated scores over 25 days.

Table 1
Study descriptive statistics.

Variable	*M*	*SD*	*Min*	*Max*
Enjoyment	3.89	1.37	1.00	6.00
Boredom	1.88	1.12	1.00	6.00
Effective use of text-reduction strategies	7.16	1.23	3.36	9.84
Achievement	4.38	0.78	2.00	6.00

Table 2 shows variance components and intra-class correlations (ICCs) for enjoyment, boredom and effective use of text-reduction strategies, calculated from unconditional random effects models. The Level 2 ICCs for enjoyment (0.524) and boredom (0.492) are similar in magnitude. Thus, the variance in both emotions is attributable to intraindividual and interindividual components to a similar extent, whereas the variance in the effective use of text-reduction strategies (0.320) is mostly attributable to intraindividual components. The Level 3 ICCs are low for the three variables enjoyment (0.083), boredom (0.047) and effective use of text-reduction strategies (0.065). Therefore, only a two-level structure was retained in our analyses.

Table 2

Variance components and intra-class correlations (ICCs) for effective of text-reduction strategies, enjoyment and boredom.

	Variance level 1 – situation	Variance level 2 – person	Variance level 3 – classroom	Level 2 ICC	Level 3 ICC
Enjoyment	1.324	1.773	0.283	.524	.083
Boredom	1.052	1.123	0.107	.492	.046
Effective use of text-reduction strategies	2.651	1.381	0.282	.320	.065

Note. ICC: Variance on the respective level divided by total variance.

Table 3 shows intraindividual as well as interindividual correlations between enjoyment, boredom and effective use of text-reduction strategies. Correlations below the diagonal are intraindividual correlations, above the diagonal are interindividual correlations. As can be seen, the correlations between enjoyment and boredom and effective use of text-reduction strategies differ with regard to intra- and interindividual analyses.

Table 3

Correlations of predictors.

Variable	1	2	3	4
1. Enjoyment	–	–0.440***	0.095†	–0.027
2. Boredom	–0.255***	–	–0.184**	0.003
3. Effective use of text-reduction strategies	0.048***	–0.026*	–	.446***
4. Achievement	–	–	–	–

Note. Correlations above the diagonal are interindividual correlations; correlations below the diagonal are intraindividual correlations

$N_{intraindividual}$= 8020 (assessments within students); $N_{interindividual}$= 338 (students)

† $p < .10$ *$p < .05$ **$p < .01$ ***$p < .001$

In linear mixed models with random intercepts between persons, the linear trend significantly predicted the effective use of text-reduction strategies, $B = 0.034$; $p < .001$, as examined in assumptions one and two. Furthermore, it also predicted boredom, $B = –0.009$; $p < .001$, but not enjoyment, $B = 0.002$; $p = .281$, which were both examined in assumptions four and three. Modeling curvilinear relations with quadratic or cubic trends did not improve the models. The linear trend was therefore included as a covariate in subsequent analyses. Allowing for random effects of the linear trend between persons resulted in further improvements for effective usage of text reduction strategies (assumptions one and two) ($\Delta \chi^2 = 140$; $df = 1$; $p < .001$) as well as for enjoyment (assumption three) ($\Delta \chi^2 = 587$; $df = 1$; p

< .001) and boredom (assumption four) ($\Delta \chi^2 = 578$; $df = 1$; $p < .001$), and were thus retained in subsequent analyses.

3.2. Main analyses

3.2.1. Do students' enjoyment and boredom influence the effective use of their subsequent cognitive learning strategies?

Table 4 shows the results of the linear mixed effects model for effective use of text-reduction strategies predicted by students' emotions of enjoyment (assumption one) and boredom (assumption two), with time, academic achievement and gender as covariates. Intraindividual *enjoyment* positively predicted the effective use of text-reduction strategies, $\beta = 0.064$; $p = .002$, indicating that when students started to work on a text with more enjoyment than on other texts, they also used text-reduction strategies more effectively in this text. Intraindividual *boredom* did not have a significant effect on effective use of text-reduction strategies, $\beta = 0.012$; $p = .555$. The effective use of text-reduction strategies did not play a role in whether students began working on a text feeling more bored than on other texts. The results of interindividual analyses, however, differed from the results of intraindividual analyses. Interindividual *enjoyment* did not predict the effective use of text-reduction strategies, $\beta = 0.043$; $p = .430$, as students whose level of enjoyment was on average higher than other students' enjoyment did not use text-reduction strategies more effectively. Interindividual *boredom*, on the contrary, did negatively predict effective use of text-reduction strategies, $\beta = -0.176$; $p = .002$. Students who on average felt more bored than other students used text-reduction strategies less effectively.

Time, $\beta = 0.214$; $p < .001$, and achievement, $\beta = 0.425$; $p < .001$, also positively predicted effective use of text-reduction strategies. Over the course of the 25 texts, students applied text-reduction strategies more effectively. Moreover, students with a higher academic achievement also used text-reduction strategies more effectively.

Table 4
Effective use of text-reduction strategies predicted by students' enjoyment and boredom.

	Quality of text-reduction strategies		
Fixed effects	*B*	*SE B*	β
Intercept	3.615	0.368	7.272***
Effective use of text-reduction at t -1	0.137	0.013	0.273
Enjoyment intra**a**individual	0.058	0.018	0.064**
Enjoyment inter**er**individual	0.032	0.041	0.043
Boredom intra**a**individual	0.012	0.021	0.012
Boredom inter**er**individual	-0.158	0.051	-0.176**
Time	0.031	0.034	0.214***
Achievement	0.549	0.064	0.425***
Gender	0.161	0.101	0.080
Random effects	Variance	*SD*	
Intercept	0.585	0.765	
Time	0.001	0.029	
Residual	2.237	1.496	

Note. $N_{intra\text{individual}}$= 5956 (assessments within students); $N_{inter\text{individual}}$= 335 (students);
Unstandardized regression coefficients; p< .001*** p< .01**, p< .05 * after Benjamini-Hochberg correction (Benjamini & Hochberg, 1995)

3.2.2. Does the effective use of students' cognitive learning strategies influence students' subsequent enjoyment and boredom?

Table 5 shows the results of the linear mixed effects model for students' enjoyment predicted by their effective use of text-reduction strategies (assumption three), with boredom, time, academic achievement and gender as covariates. Enjoyment was neither predicted by the effective use of text-reduction strategies on the intraindividual level, β= –0.021; p = .171, nor on the interindividual level, β = –0.071; p = .228. Whether students applied text-reduction strategies more effectively in one text than in other texts did not play a significant role for their experience of subsequent enjoyment. Furthermore, whether students on average applied text-reduction strategies more effectively than other students was also not related to their experience of enjoyment.

Table 5

Students' enjoyment predicted by their effective use of text-reduction strategies, with boredom, time, and achievement as covariates.

	Enjoyment		
Fixed effects	*B*	*SE B*	β
Intercept	3.610	0.379	3.896***
Enjoyment at t -1	0.252	0.013	0.441***
Effective use of text-reduction strategies intra**a**individual	-0.013	0.010	-0.021
Effective of text-reduction strategies inter**er**individual	0.058	0.048	-0.071
Boredom intra**a**individual	-0.263	0.015	-0.256***
Boredom inter**er**individual	-0.421	0.048	-0.471***
Time	-0.001	0.003	-0.006
Achievement	-0.085	0.071	-0.066
Gender	0.101	0.101	0.050
Random effects	Variance	*SD*	
Intercept	0.629	0.793	
Time	0.002	0.042	
Residual	1.024	1.012	

Note. $N_{intra\underline{a}individual}$= 5480 (assessments within students); $N_{inter\underline{er}individual}$= 330 (students);
Unstandardized regression coefficients; p< .001*** p< .01**, p< .05 * after Benjamini-Hochberg correction (Benjamini & Hochberg, 1995)

Table 6 shows the same analysis for *boredom* (assumption four), with enjoyment added as intraindividual and interindividual covariates. Boredom was not predicted by the effective use of text-reduction strategies on the intraindividual level, β = 0.006; *p* = .672, indicating that a more effective use of text-reduction strategies in one text compared to other texts did not play a significant role for students' experience of subsequent boredom. However, boredom was negatively predicted by the effective use of text-reduction strategies on the interindividual level (β = –0.137; *p* = .004). Students who on average used text-reduction strategies more effectively were less bored. Furthermore, time negatively predicted boredom (β = –0.053; *p* = .008), as students felt less bored over the course of the 25 texts.

Table 6
Students' boredom predicted by their effective use of text-reduction strategies, with enjoyment, time and achievement as covariates.

	Boredom		
Fixed effects	*B*	*SE B*	β
Intercept	3.302	0.312	1.795***
Boredom at t -1	0.230	0.013	0.331***
Effective use of text-reduction strategies intra**a**individual	0.004	0.008	0.006
Effective of text-reduction strategies inter**er**individual	-0.112	0.039	-0.137**
Enjoyment intra**a**individual	-0.195	0.012	-0.218***
Enjoyment inter**er**individual	-0.313	0.031	-0.429***
Time	-0.008	0.003	-0.053**
Achievement	0.041	0.059	0.031
Gender	0.012	0.084	0.006
Random effects	Variance	*SD*	
Intercept	0.419	0.647	
Time	0.001	0.037	
Residual	0.779	0.882	

Note. $N_{intra\underline{a}individual}$= 5457 (assessments within students); $N_{inter\underline{er}individual}$= 331 (students);
Unstandardized regression coefficients; p< .001*** p< .01**, p< .05 * after Benjamini-Hochberg correction (Benjamini & Hochberg, 1995)

4. Discussion

We examined the relationship – with a focus on the direction of effects – between students' enjoyment and boredom and their use of cognitive learning strategies. Theoretically, the influence could go in both directions (Pekrun, 2006; Pekrun & Perry, 2014) and knowledge about these links is helpful to optimally support students during their learning process. We chose a sequential design in which students' emotions of enjoyment and boredom as well as their use of learning strategies were measured subsequently on a daily basis. All measurements took place during real learning situations. Instead of the frequency of cognitive learning strategy use, we applied a different approach and measured students' effective use of cognitive learning strategies. As research shows that students often report to use learning strategies very frequently, albeit not necessarily competently (Obergriesser & Stoeger, 2015), this differentiation seems to be essential. Measuring and providing feedback on the effective use of strategies is important because students who know

that they are able to apply learning strategies competently should perceive control over their learning process, which should in turn influence their emotions. Firm causal relationships can only be derived from experiments. Our sequential design, however, allows us to gain first insights into the temporal ordering of effects between students' emotions of enjoyment and boredom and their effective use of learning strategies. Furthermore, our method also enables us to draw comparisons to previous cross-sectional studies by not only analyzing intraindividual but also interindividual effects.

4.1. Do students' enjoyment and boredom influence the effective use of their subsequent cognitive learning strategies?

Enjoyment was a significant positive predictor of the effective use of students' cognitive learning strategies on the intraindividual level. The higher students' enjoyment was when starting work on one text, the more effective their use of text-reduction strategies in this task was. This seems to corroborate our assumptions based on the control-value theory of achievement emotions (Pekrun, 2006; Pekrun & Perry, 2014) that enjoyment positively influences the effective use of learning strategies within students. On the interindividual level, enjoyment was not related to the effective use of students' cognitive learning strategies. This is contradictory to most previous cross-sectional studies, all examining interindividual differences, and coming to the conclusion that students who enjoy learning more make use of cognitive learning strategies more frequently (e.g. Artino & Jones, 2012; Chatzistamatiou et al., 2015). However, these studies measured the frequency of cognitive learning strategy use among students, while our study assessed the effective use of cognitive learning strategies and therefore whether students applied learning strategies competently. Taking into account how effectively cognitive learning strategies are applied, our results suggest that it is not important how much students enjoy learning on average. Instead, as soon as students show an increase in enjoyment, it has a positive influence on the effective use of their cognitive learning strategies resulting in a more competent implementation of text-reduction strategies.

Boredom, as opposed to enjoyment, was not a significant predictor of the effective use of students' cognitive learning strategies on the intraindividual level. Contrary to our assumptions, the effective use of cognitive learning strategies does not seem to be influenced by students feeling more or less bored when starting work on one text. Several explanations for this result are possible: First, our study did not differentiate clearly between boredom felt

due to over-challenging situations and boredom felt due to under-challenging situations (e.g. Acee et al., 2010). Similar to other researchers (e.g. Pekrun et al., 2010) who expected their students to experience boredom due to over-challenging situations as the tasks they asked students to do were demanding, we also expected the students in our study to experience boredom due to over-challenging situations, as the texts the students had to work on were rather difficult. However, some students might also have felt bored as they were already able to apply learning strategies competently. Boredom due to feeling under-challenged might level out the effects of boredom experienced by students feeling over-challenged. Post-hoc analyses show, however, that boredom due to feeling over-challenged seemed to be the most prevalent in our study, as supported by Figure 1, where boredom reported by the 10 percent of students with the least effective use of learning strategies is contrasted to boredom reported by the 10 percent of students with the most effective use of learning strategies.

Second, possible effects of boredom on the effective use of students' cognitive learning strategies might not have become visible, as boredom in general was rather low among all students. This interpretation is, however, less likely, as interindividual analyses of all students in our study, do show a significant negative link between boredom and the effective use of cognitive learning strategies. This finding is similar to those from studies assessing boredom and the frequency of cognitive learning strategy use (e.g., Artino & Jones, 2012; Pekrun et al., 2002; Pekrun et al., 2011). Third, occasional boredom might not affect the effective use of students' learning strategies. Even if students are sometimes more bored when they work on one text than on another, it might not affect the effective use of their text-reduction strategies, as their knowledge of strategies can compensate for reduced cognitive resources. Only if students are regularly bored, it might show a negative effect on the effective use of their learning strategies. Further studies are needed to follow up on this finding and the possible influence of boredom on the effective use of cognitive learning strategies.

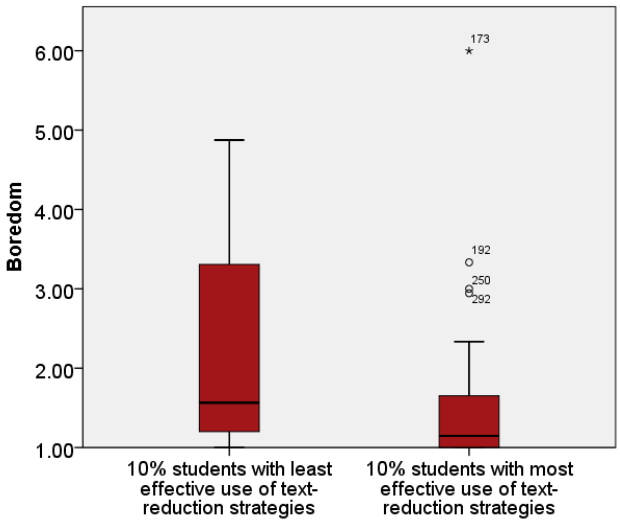

Figure 1

Average boredom experienced by students grouped according to the average effectiveness of their text-reduction strategy use.

Predicting the effective use of cognitive learning strategies, we only find small autoregressive effects for this variable. Overall, students improved on their effective use of text-reduction strategies over the course of the 25 texts as it can be seen in the significant positive effect of the linear trend variable. However, from day to day, the effectiveness of their strategy use differed. Every day students were informed about the effectiveness of their strategies on the previous day, then when they started working on the next text, they made use of this feedback and tried out new ways to improve on their strategies. This did not always lead to immediate success, but varied along the learning process, leading to small autoregressive effects in our analyses.

4.2. Does the effective use of students' cognitive learning strategies influence students' subsequent enjoyment and boredom?

Neither enjoyment nor boredom predicted the effective use of students' cognitive learning strategies on the intraindividual level. Whether students used learning strategies more effectively in one task did not seem to influence how they felt when they started a new, similar task. One explanation for this finding could be that the tasks the students were asked to do and in which they could demonstrate competency was not important enough to influence their emotions. As students were told they would not receive any grades for their work on the texts, students might have done their work without notable emotional commitment. In further studies, researchers should create environments that make sure that

students are highly committed to the tasks. There are, however, findings in our study which support the assumption that the effective use of students' cognitive learning strategies possibly influences students' boredom: Looking at the time trends in our analyses, we see that while the effective use of their learning strategies increased over the course of the texts, boredom decreased. If the effective use of learning strategies had no effect on boredom at all, we would expect boredom to increase over time, as students were asked to repeat the same task (finding main ideas in a text using text-reduction strategies) so many times. However, by applying cognitive learning strategies regularly over several weeks and being told about their effectiveness, students seem to have learned to apply cognitive learning strategies more competently over time. This might have had a positive impact on students' perceived control and consequently students might have experienced less and less boredom due to over-challenging situations. Further studies are needed to follow up on these results.

Interindividual differences in the effective use of learning strategies were not significant for enjoyment, but were a significant negative predictor of boredom. The same differences were shown in our previous analysis on the influence of students' emotions on the effective use of their learning strategies. As already explained above, these differences cannot be interpreted within a direction of effects and were the same as outlined in the section on the influence of students' emotions of enjoyment and boredom on the effective use of learning strategies.

4.3. Limitations

Additionally to the aforementioned limitations (no differentiation between boredom due to over-challenging and boredom due to under-challenging situations, students' possible lack of commitment and value for the tasks at hand), there are some, more general limitations to our study. First, we only evaluated two emotions, enjoyment as a positive activating emotion and boredom as a negative deactivating emotion. Both emotions belong to the most intensely and frequently experienced emotions in school (Goetz et al., 2007; Pekrun et al., 2002). Yet, there are a number of other emotions, that are also relevant for learning and which need further investigation (e.g. confusion, frustration or pride; D'Mello & Graesser, 2012; Pekrun & Stephens, 2012). Although test-anxiety has been vastly assessed in relation to achievement outcomes (cf. Zeidner, 1998), studies explicitly looking at causal relationships between anxiety and the use of cognitive learning strategies are currently missing. Second, apart from cognitive learning strategies, metacognitive learning strategies such as goal setting or

monitoring play an important role in students' learning (de Boer, Donker, Kostons, & van der Werf, 2018; Weinstein et al., 2000) and are also related to students' emotions (Mega, Ronconi, & de Beni, 2014). Future studies should therefore look at further emotions and also include metacognitive learning strategies. Third, in our research we aspired to learn more about the direction of effects between students' enjoyment and boredom and their use of cognitive learning strategies. Although our research builds on sequential measurements of these emotions and learning strategies during real learning situations, we can only gain first insights into the direction of effects. Experimental research is needed to further disentangle possible causal effects. Fourth, following the control-value theory of achievement emotions (Pekrun, 2006; Pekrun & Perry, 2014), we argued that the effective use of learning strategies is linked to students' perceived control and, therefore, subsequent emotions. Although perceived control as an antecedent to achievement emotions is well established in the literature (e.g. Buff, 2014; Goetz et al., 2010; Goetz & Hall, 2014), it might be worthwhile to also include measurements of perceived control, as done for example in Muis, Psaradellis et al.'s (2015) study, in future studies. Fifth, students were asked to indicate their emotions with regard to working on the task, immediately after they had received feedback on the effectiveness of their strategy use the day before and before they began working on the new task. However, it cannot be discounted that some students might have indicated their current mood without any relation to the learning task. Furthermore, as emotions can change quickly (Ekman, 1994), future studies should examine the changes of emotions during the learning process (c.f. Di Leo et al., 2019) and possible effects on the effective use of students' learning strategies, for example, by adopting an experience sampling approach (e.g. Goetz, Sticca, Pekrun, Murayama, & Elliot, 2016). Finally, while experience sampling and the approach we used in this study are particularly effective for measuring learning behavior in a non-reactive manner, social desirability biases must nevertheless be kept in mind.

5. Conclusion

The present study contributes to the understanding of the relationship between students' enjoyment and boredom and their use of cognitive learning strategies as well as the possible direction of effects between these constructs. Even though further studies are needed, first, cautious, implications for educational practice can be made. For the effective use of learning strategies, it seems to play a minor role how much students enjoy learning on average; rather temporary increases in enjoyment seem to be important. An increased personal level of

enjoyment seems to have an immediate positive effect on the effective use of students' learning strategies. Even though the results on boredom need to be followed up on in future studies, it is worthwhile to note that boredom decreased over time, even though students had to complete the same task repeatedly. It seems that if students are able to systematically improve their competency by repeating similar tasks and getting adequate feedback, working on similar tasks for a longer period of time seems to not increase their experience of boredom. Teachers and researchers alike might want to keep these findings in mind, when designing lessons and interventions to support students' learning processes. Research agrees on the benefits of learning strategies for learning and achievement (e.g. Murayama et al., 2013; Nota et al., 2004). Our findings suggest that enjoyment has a positive impact on this process.

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III Artikel 2

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The influence of emotions and learning preferences on learning strategy use before transition into high-achiever track secondary school

Abstract

Research on the relationships between students' achievement emotions and their (self-regulated) learning behavior is growing. However, little is known about the relationships between students' learning preferences and achievement emotions and the extent to which these influence learning strategies. In this study we, first, looked at the learning-style preferences (self-regulated, externally regulated, or impulsive learning) of 200 fourth graders who were about to start high-achiever track secondary school in Germany in the following school year. Second, we analyzed whether students who prefer self-regulated learning, externally regulated learning, or impulsive learning differ concerning the achievement emotions of enjoyment, anger, boredom, and anxiety. Third, we examined whether the degree to which students prefer self-regulated learning in combination with their achievement emotions predicts if and how students actually apply various aspects of self-regulated learning such as cognitive learning strategies, goal setting, and strategy monitoring during their learning. Fourth, we explored whether achievement emotions mediate relationships between more or less successful learning and subsequent learning behavior. Students in our sample did not prefer a self-regulated learning style over an externally regulated or impulsive learning style; and achievement emotions were shown to be related to students' learning-style preferences. Students' preference for self-regulated learning in combination with their achievement emotions predicted various aspects of their learning. However, achievement emotions did not mediate changes in learning behavior found after less successful learning.

Keywords: achievement emotions; learning preferences; self-regulated learning; learning strategies

1. Introduction

How students learn becomes increasingly important over the course of their school careers. As they progress from primary school to secondary school and into college, students' homework and tests become increasingly frequent and difficult, and their teachers expect greater self-regulatory competencies (Cooper, Lindsay, Nye, & Greathouse, 1998; Zimmerman & Kitsantas, 2005). This is especially true for high-achieving students in Germany who transfer to the high-achiever track secondary school.[1] Yet, students do not necessarily prefer self-regulating their learning. On the contrary, primary school students of all achievement and intelligence levels do not prefer a self-regulated learning style to externally regulated or impulsive learning styles (Sontag, Stoeger, & Harder, 2012; Stoeger & Sontag, 2012). While self-regulated learners, for example, set their own goals, plan the use of learning strategies, and monitor their implementation of the latter, externally regulated learners prefer it when their teachers or their parents take over these parts of the learning process. Impulsive learners do not reflect on their learning very much and prefer to start learning without setting goals or planning their learning process in advance.

One reason for the lack of a preference for self-regulated learning among primary school students might be that the necessary skills were not taught successfully. However, studies indicate that this seems not to be the only reason (Stoeger, Sontag, & Ziegler, 2014). As learning − and also self-regulated learning − seems to be closely linked to achievement emotions (Pekrun & Linnenbrink-Garcia, 2014; Pekrun & Schutz, 2007), we assume that not only learning behavior, but also learning-style preferences are related to students' emotions. While there are numerous studies (cf. Pekrun & Linnenbrink-Garcia, 2014) that analyze the relationships between learning behavior and achievement emotions, studies on the relationships between learning-style preferences and achievement emotions are missing so far.

The aims of our study were therefore, first, to find out which learning styles (self-regulated, externally regulated, or impulsive learning) students prefer who plan to attend the high-achiever track of secondary school after completion of primary school. The second aim was to analyze the relationships between the preference for the different learning styles and the most common trait achievement emotions. What seemed even more interesting was,

[1] The German school system mainly consists of three different secondary school types, differing by means of achievement standards. One can distinguish between Hauptschule (lowest level; 5 years), Realschule (mean level; 6 years) and Gymnasium (highest level; 8 years), each allowing for different graduation diplomas. A diploma from Gymnasium entitles students to study at university. Some federal states also offer comprehensive schools where all students, regardless of their achievement level, attend the same school. However, this is not the case in the federal state of Bavaria, where our study was conducted.

third, to find out whether the degree to which students prefer self-regulated learning in combination with their trait achievement emotions predicts if and how they actually apply various aspects of self-regulated learning such as cognitive learning strategies, goal setting, and strategy monitoring. However, emotions might not only predict learning strategies; they may also be influenced by success and failure during the learning process and may at the same time influence subsequent learning behavior. Therefore, our fourth aim was to find out whether achievement emotions experienced in the learning situation (i.e. state emotions) mediate relationships between more or less successful learning (as measured by goal deviations) and subsequent learning behavior (i.e. strategy monitoring).

2. Theoretical Background

2.1. Students' learning-style preferences

Literature on learning styles differs a lot in how learning styles are conceptualized and assessed (cf. Coffield, Moseley, Hall, & Ecclestone, 2004; Pashler, McDaniel, Rohrer, & Bjork, 2008), and students differ in their preferences for the various learning styles (Pashler et al. 2008). While many popular approaches to learning styles (e.g. Dunn, Dunn, & Price, 1989; Gregorc, 1982; Kolb, 1985) focus mainly on how information is presented and how knowledge is constructed, a different approach deals with the question how learning processes are regulated and who is in charge of this regulation (Ziegler, Stoeger, & Grassinger, 2010).

The regulation approach to learning styles focuses on the self-regulated, externally regulated, or impulsive use of cognitive and metacognitive learning strategies, which are also an integral part of self-regulated learning (e.g. Winne, 2011; Zimmerman, 2000). A self-regulated learning style is defined by students' planning and using cognitive and metacognitive learning strategies of their own accord. Students who prefer this learning style apply rehearsal, organization, or elaboration strategies in order to construct and retain new knowledge of their own accord. To control and regulate the acquisition of knowledge, they prefer, for example, setting their own goals and monitoring their learning. Pintrich's (2000) definition of self-regulated learning mirrors this approach, as he defines self-regulated learning as an "active, constructive process whereby learners set goals for their learning and then monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and contextual features in the environment" (Pintrich, 2000, p. 453). Students who prefer leaving the choice of learning strategies and processes such as planning and monitoring to their teachers or parents prefer an externally regulated learning

style. Students who prefer skipping these strategies altogether and learn without consciously using any cognitive or metacognitive learning strategies prefer an impulsive learning style. Proponents of this regulation approach to learning styles do not suggest that instruction methods be tailored to students' preferences for the different learning styles (Ziegler et al., 2010). Instead, a self-regulated learning style is clearly regarded preferable, as research shows that self-regulated learning is associated with adaptive learning behavior and better performance (Boekaerts, Pintrich, & Zeidner, 2000; Zimmerman & Schunk, 2011).

2.2. The importance of cognitive and metacognitive learning strategies for successful self-regulated learning

There is an extensive body of research on the effectiveness of cognitive and metacognitive learning strategies (Hattie, Biggs, & Purdie, 1996), which are the core of the self-regulated learning style. Students' preferences for these strategies are not well understood. Therefore, we first summarize studies on the effectiveness of cognitive and metacognitive learning strategies, before we present the findings of the few studies that investigated students' preference for self-regulated learning.

Cognitive learning strategies support the acquisition and organization of information. The effectiveness of cognitive learning strategies was recently examined in a longitudinal study (Murayama, Pekrun, Lichtenfeld, & vom Hofe, 2013). The researchers followed secondary school students from year 5 to year 10, and found that while the initial level of students' achievement was strongly related to intelligence, with motivation and cognitive learning strategies explaining additional variance, only cognitive learning strategies together with motivation were predictors of achievement growth. Furthermore, Nota, Soresi, and Zimmerman (2004) examined students' use of learning strategies during the final year of high school and their subsequent academic performance at university. The use of cognitive organization strategies proved to be a significant predictor for students' achievement at university.

Metacognitive strategies contribute to the optimal implementation of cognitive learning strategies. The strategy of goal setting is seen as a key process (Pintrich, 2000; Zimmerman, 2008a). The most advantageous goals are goals which are proximal (i.e. short term), challenging, and task specific (Bandura & Schunk, 1981; Schunk, 1983; Zimmerman, 2008a). Students who set goals for themselves perform significantly better, for instance, in writing tasks (Zimmerman & Kitsantas, 1999) or mathematics (Bandura & Schunk, 1981). Furthermore, goal setting positively influences persistence when learning (LaPorte & Nath,

1976). However, though goals should be challenging, they are only assumed to be helpful for effective self-regulated learning if they are still attainable. Overly ambitious goals and subsequent failure to attain them can produce adverse self-reactions and negatively influence students' learning (Zimmerman, 2008a). Moreover, goal setting can enhance other metacognitive strategies such as planning and monitoring (Locke & Latham, 2006).

Monitoring of the learning process guides learning activities towards goals (Zimmerman, 1998). It implies that students systematically observe and evaluate their learning while they are still involved in the current learning activity (Zimmerman & Paulsen, 1995). Monitoring helps students to identify discrepancies between their goals and the current status of a task (Butler & Winne, 1995). It provides internal feedback on the quality of the current learning process. As a consequence, learners can adapt their cognitive strategies if necessary. Students who were asked to monitor their progress in attaining goals performed better than students who also set goals, but who were not asked to monitor their progress in goal attainment (Zimmerman & Kitsantas, 1997).

Even if the importance and effectiveness of cognitive and metacognitive learning strategies for the process of self-regulated learning are corroborated, it is also of importance whether students actually prefer this learning style. Sontag et al. (2012) assessed students' learning-style preferences to find out whether students preferred a self-regulated, an externally regulated, or an impulsive learning style. Their findings were alarming, as only one third of the students preferred a self-regulated learning style over an externally regulated or impulsive learning style, regardless of their intelligence level. A study by Sontag and Stoeger (2015) supported these findings for high-achieving and highly intelligent students, who also chose self-regulated learning as their preferred approach to learning for little more than one third of the learning situations in question. Obergriesser and Stoeger (2014) found similar patterns among high-achieving and highly intelligent students. In their sample, only students with average achievement preferred self-regulated learning slightly more and chose self-regulated learning as their preferred approach to learning for 45% of the learning situations in question.

There are several possible explanations for these weak preferences for self-regulated learning. For example, teaching the necessary skills to the students might not have been successful. A study by Stoeger, Sontag, and Ziegler (2014) indicated that there might be another explanation. Considering that numerous studies showed that learning is closely related to achievement emotions (Pekrun & Schutz, 2007; Pekrun & Linnenbrink-Garcia,

2014), an alternative assumption could be that in addition to learning behavior, also students' learning-style preferences could be linked to students' achievement emotions.

2.3. Emotions in the learning process −relationships with cognitive and metacognitive learning strategies

Research on emotions with regard to learning behavior and learning strategies is growing. However, to date, there are no studies that explicitly examine students' learning-style *preferences* with regard to self-regulated, externally regulated, and impulsive learning and their relationships to achievement emotions. After defining the most widespread achievement emotions in the classroom, we will therefore describe findings on the relationships between these achievement emotions and cognitive and metacognitive learning strategies. We will then present our current study in which we will take a closer look at relationships between students' learning-style preferences and achievement emotions as well as their actual learning behavior.

Achievement emotions are emotions that are directly tied to achievement activities (e.g. studying) or achievement outcomes (success and failure) (Pekrun, 2006; Pekrun & Perry, 2014). Following the distinction between state and trait emotions (Cattell & Scheier, 1961; Spielberger, 1972), students' achievement emotions can be seen as affective states that are experienced within specific situations and that are only of short duration, or as affective traits that are habitual and relate to students' average affective tendencies over time. Highly prevalent in classroom settings are the emotions of enjoyment, anger, boredom, and anxiety (Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007; Pekrun, Goetz, Titz, & Perry, 2002). They can be differentiated by their valence (positive vs. negative) and their level of arousal (activating for high levels of arousal and deactivating for low levels of arousal) (cf. also circumplex models of affect; Feldman Barrett, & Russell, 1998).

Enjoyment, a positive emotion, is experienced when there is a match between an individual's personal goals and the learning task (Linnenbrink, 2007), if studying certain content is positively valued, and if the activity is perceived as sufficiently controllable by the individual (Pekrun, 2006). Enjoyment can be contrasted with the emotion of relaxation by its level of arousal or activation. While relaxation is a deactivating emotion with low levels of arousal, enjoyment is an activating emotion with high levels of arousal (Pekrun, 2006). Students who experience enjoyment in a learning situation might, for example, actively search for ways to optimize their learning.

The negative emotions of anger, anxiety, and boredom can all be described as unpleasant affective states (Boekaerts, 1993; Harris, 2000; Zeidner, 1998). The emotions of anger and anxiety can be differentiated from boredom by their activation level. While anger and anxiety are both classified as activating emotions with high physiological arousal, boredom is regarded as a deactivating emotion that is associated with low physiological arousal (Pekrun, 2006). Boredom is experienced when a learning activity is neither valued positively nor negatively. Bored students, for example, might not think about their learning process at all.

Anger is experienced when a learning activity is negatively valued, for example, when a student wishes to do something else or does not enjoy investing effort, but perceives the learning activity or its content as controllable. Anger can also be experienced if learning is positively valued, but a learner experienced failure instead of success and now attributes this failure to his or her own erroneous behavior that he or she could have controlled (Pekrun, 2006). Anger is often considered to be approach related, promoting an effort to restore desired states (Carver & Harmon-Jones, 2009). Students who are angry about previous failure, for example, might invest more effort or change their learning behavior in future learning situations in order to attain success.

Anxiety, as another activating negative emotion, is experienced when a learning activity is positively valued, but students perceive a lack of control over their learning and therefore fear failure (Pekrun, 2006; Zeidner, 1998). In contrast to anger, anxiety is considered to be related to avoidance behavior (Carver & Harmon-Jones, 2009). Bandura (1977) points out that people fear and tend to avoid situations which they believe to exceed their coping skills. Anxious students, for example, might prefer leaving the regulation of their learning to other agents like teachers, whom they might perceive as more competent for this task.

We will now look at the empirical findings on the relationships between achievement emotions and cognitive and metacognitive learning strategies. The studies we present relate to students' trait emotions, as research that includes state emotions and their relationships to learning strategies is scarce.

The positive emotion of enjoyment in learning contexts is positively related to performance (e.g. Lichtenfeld, Pekrun, Stupnisky, Reiss, & Murayama, 2012; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011) and correlates with adaptive learning behavior. Students who reported more enjoyment also reported more engagement (Ainley & Ainley, 2011). Furthermore, they reported using more cognitive learning strategies (e.g. rehearsal,

organization, or elaboration strategies) and more metacognitive strategies, such as planning and monitoring (King & Areepattamannil, 2014; Pekrun et al., 2002), which are central to self-regulated learning. While all of these studies were correlational and cross-sectional, Ahmed, van der Werf, Kuyper, and Minnaert (2013) found in their longitudinal study of seventh graders that changes in positive emotions in the course of the school year were consistently linked to changes in self-regulated learning: The steeper the rate of decline in students' enjoyment, the steeper was the rate of decline in cognitive and metacognitive strategy use.

The relationships between negative emotions and learning processes are more complex. Test anxiety is well researched. It is negatively related to performance outcomes, for example, in mathematics, reading comprehension, and working memory tasks (Eysenck, Derakshan, Santos, & Calvo, 2007). Many test-anxious students experience deficits regarding study skills (Zeidner, 1998). Naveh-Benjamin and his colleagues (Naveh-Benjamin, McKeachie, & Lin, 1987) found that test-anxious university students lacked cognitive organization skills. Veenman, Kerseboom, and Imthorn (2000) showed the mediating role of metacognitive skills in the relation between test anxiety and performance among secondary school students. Students with lower levels of test anxiety were better at using metacognitive strategies, such as monitoring, than highly test-anxious students. Research on writing strategies showed that the lower their level of anxiety, the more students used metacognitive strategies (Stewart, Seifert, & Rolheiser, 2014).

A meta-analysis on the emotion of boredom and its relationship to academic outcomes (Tze, Daniels, & Klassen, 2015) showed an overall negative relation between boredom and academic outcomes. Students who reported higher levels of boredom had lower achievement in primary school (Lichtenfeld et al., 2012) and also in secondary school (Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010) and in college (Pekrun et al., 2011). Boredom and achievement seem to be linked reciprocally, with high boredom leading to low achievement and vice versa (Pekrun, Hall, Goetz, & Perry, 2014). With regard to cognitive strategy use, research showed that boredom was negatively related to cognitive rehearsal and elaboration strategies (Artino, 2009; Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010; Pekrun et al., 2011). Metacognitive strategies and boredom are negatively related as well. Artino and his colleagues found a negative relationship between boredom and metacognitive strategy use in general (Artino, 2009; Artino & Jones, 2012), while Perry and colleagues specifically showed the negative relation between boredom and monitoring (Perry, Hladkyj, Pekrun, & Pelletier, 2001).

The few existing studies on the relationships between anger and performance on the one hand, and between anger and learning strategies on the other hand, seem to show results similar to those for anxiety and boredom. However, for anger these relationships seem to be weaker and less clear. Several studies found negative relationships between anger and performance in primary school (Lichtenfeld et al., 2012), secondary school (Goetz et al., 2010), and college (Pekrun et al., 2011). However, in her study with primary school students, Boekaerts (1993) did not find negative correlations between anger and students' grade point average. Looking at the relation between anger and students' use of cognitive learning strategies, studies showed that anger correlated negatively with cognitive elaboration strategies among college students (Pekrun et al., 2002) and that anger negatively predicted students' use of cognitive rehearsal strategies, but showed no relation to organization and elaboration strategies among secondary school students (King & Areepattamannil, 2014). With regard to metacognitive strategies, Pekrun and colleagues (2002) found negative relationships between anger and a self-regulation scale that included several metacognitive aspects such as goal setting and monitoring, while in the study by King and Areepattamannil (2014), anger negatively predicted regulation but was not significantly related to monitoring.

To sum up, trait emotions were shown to be interlinked with the learning process of students in primary and secondary school, as well as in college. Enjoyment positively relates to cognitive and metacognitive strategies, while anxiety and boredom negatively relate to these strategies. The relationships between anger and these strategies are also negative, albeit weaker. This led us to assume that students' preference for applying cognitive and metacognitive strategies, and therefore their preference for self-regulated learning, might be closely related to achievement emotions as well.

2.4. Current study

This is the first study that looks at students' achievement emotions and their learning-style preference (self-regulated, externally regulated, or impulsive learning), and examines whether achievement emotions in combination with preference for self-regulated learning predict the use of and competence in learning strategies. In these analyses, students' trait achievement emotions are, like preferences, regarded as rather stable over time (Pashler et al., 2008; Spielberger, 1972). Furthermore, while studies on relationships between achievement emotions and cognitive and metacognitive learning strategies have mainly focused on trait achievement emotions, this study also includes analyses of a possible mediating effect of state emotions on learning behavior, while controlling for trait

achievement emotions and learning-style preferences. We focus on students who are about to enter the high-achiever track of secondary school, a challenging learning environment, in which a self-regulated learning style and therewith the use of cognitive and metacognitive learning strategies are especially important.

Our first goal was to examine which learning styles (self-regulated, externally regulated, or impulsive) students who will attend the high-achiever track of secondary school prefer. Given the empirical results summarized above (Obergriesser & Stoeger, 2014; Sontag & Stoeger, 2015; Sontag et al., 2012), we did not expect these students to prefer a self-regulated learning style over an externally regulated or impulsive learning style.

Our second goal was to examine whether the different learning-style preferences are related to students' trait achievement emotions of enjoyment, boredom, anxiety, and anger. Based on the correlational research findings in which positive relationships between enjoyment and adaptive learning behavior are reported (Ahmed et al., 2013; Ainley & Ainley, 2011; Pekrun et al., 2002), we assumed that preference for a self-regulated learning style and enjoyment are positively related. Students who prefer a self-regulated learning style might experience more enjoyment than students who prefer an externally regulated or impulsive learning style. According to research on boredom and anxiety, for which negative correlationships with learning strategies were found (e.g. Artino, 2009; Artino & Jones, 2012; Naveh-Benjamin et al., 1987; Pekrun et al., 2010; Pekrun et al., 2011; Perry et al., 2001; Veenman et al., 2000; Zeidner, 1998), we assumed that students who prefer a self-regulated learning style experience less boredom and less anxiety than students who prefer an external or impulsive learning style. Given that anger is negatively related to learning strategies (King & Areepattamannil, 2014; Pekrun et al., 2002), but the relationships seem to be weaker than for boredom and anxiety, it is hard to see how anger could be related to students' preference for a self-regulated, externally regulated, or impulsive learning style.

Our third goal was to examine whether the degree to which students' preference for self-regulated learning in combination with their trait achievement emotions predicts the use and quality of cognitive and metacognitive learning strategies. To do so, we looked at a learning situation in which students had to work with texts and could use cognitive learning strategies (i.e. text-reduction strategies) and metacognitive strategies (i.e. goal setting and monitoring). We chose this situation and these categories of learning strategies, as working with texts is an activity that is necessary in almost all school subjects, and as text-reduction strategies as well as goal setting and monitoring are already taught in primary school. We examined whether students use cognitive text-reduction strategies, how competent they are

in using these text-reduction strategies, as well as whether and how competently they use the metacognitive strategies of goal setting and strategy monitoring.

Based on the research findings reported above (cf. Ahmed et al., 2013; Ainley & Ainley, 2011; Pekrun et al., 2002), we expected that a high preference for self-regulated learning in combination with high enjoyment in learning situations should predict a more frequent application of cognitive text-reduction strategies and a more competent implementation of these strategies, more competent goal setting, as well as more frequent monitoring of students' own learning. With regard to the negative emotions of boredom and anxiety, we assumed that high preference for self-regulated learning in combination with low boredom and low anxiety would predict a more frequent application and a more competent implementation of all the learning strategies we examined (cf. Artino, 2009; Artino & Jones, 2012; Goetz et al., 2010; Lichtenfeld et al., 2012; Naveh-Benjamin et al., 1987; Pekrun et al., 2011, 2014; Perry et al., 2001; Tze et al., 2015; Veenman et al., 2000; Zeidner, 1998). Regarding anger and its negative but weak relation to learning strategies (King & Areepattamannil, 2014; Pekrun et al., 2002), it is difficult to make clear assumptions about whether preference for self-regulated learning in combination with anger predicts the application and implementation of learning strategies.

While the focus of the third research question is on whether students' trait achievement emotions, in combination with their preference for self-regulated learning, predict use of and competence in learning strategies, we wanted to find out in a fourth step whether state achievement emotions mediate relationships between more or less successful learning and subsequent use of learning strategies in order to explore the role of state emotions in the learning process. To do so, we examined whether students' goal deviation (and thereby success or failure in the learning process) influenced their state emotions and whether students' learning behavior, namely the metacognitive strategy of monitoring, changed as a consequence. Due to a shortage of previous research on the relationships between state emotions and the use of learning strategies, it was difficult to make straightforward assumptions. In their intervention study on self-regulated learning among university students, Schmitz and Wiese (2006) found positive correlationships between goal setting and satisfaction after learning sessions. Based on this finding and the current body of research on trait emotions, we assumed that students who had reached or surpassed their goal might experience enjoyment, as their achievement had matched their goal in the previous task and they might expect to meet that goal again in the second task. As studies showed that a lack of challenge correlates with boredom (Acee et al., 2010; Goetz & Frenzel, 2010),

attaining or surpassing one's goal might also lead to boredom in students, when students work on a subsequent task of similar difficulty level and then no longer experience the task as being challenging. Research found negative relationships between performance and anger (e.g. Lichtenfeld et al., 2012) and between performance and anxiety (e.g. Zeidner, 2014). Based on these findings, we assumed that students who had not met their goal and experienced failure might experience anger or anxiety.

Concerning the mediating role of emotions between goal attainment and changes in subsequent learning behavior, the following constellations might be expected: Because of the activation characteristic of enjoyment (Pekrun, 2006), students who had met their goals and experienced enjoyment prior to the second task might either maintain their level of strategy monitoring or even increase it in order to also attain their goal in the second text. In contrast – and corresponding to the deactivating nature of boredom (Pekrun, 2006) – students who had met or surpassed their goals and experienced boredom in the second task might reduce their strategy monitoring. As suggested by the activating nature of anger (Pekrun, 2006), students who had not met their goal and who experienced anger might increase their strategy monitoring. The same assumption might be true for students who had not met their goal and experienced anxiety, as this is also considered to be an activating emotion (Pekrun, 2006). However, anger might lead to a higher increase in strategy monitoring than anxiety, as, although both are activating emotions, anger is associated with an approach component, while anxiety is associated with an avoidance component (Bandura, 1977; Carver & Harmon-Jones, 2009).

Performance is positively related to learning strategies (cf. Zimmerman & Schunk, 2011), as well as to enjoyment (e.g. Lichtenfeld et al., 2012). The negative emotions of boredom, anxiety, and anger are negatively related to performance (e.g. Eysenck et al., 2007; Pekrun et al., 2011; Tze et al., 2015). To make sure that relationships between emotions and learning-style preferences and learning strategies not only reflect relationships to performance, students' academic achievement is included in all our analyses as a control variable.

3. Method

3.1. Participants

The sample consisted of 200 fourth grade students from 21 classrooms in 20 different schools in southern Germany. Students' mean age was 10.24 years (*SD* .33) and 60% were female; 12.6% had an immigration background, that is, they themselves or at least one of

their parents had not been born in Germany. The percentage of students with an immigration background is low compared to the 28% of students with immigration background who participated in the 2011 Progress in International Reading Literacy Study in Germany (Schwippert, Wendt, & Tarelli, 2012). Research has shown that students with immigrant backgrounds do not develop their potential as well as students with non-immigration backgrounds (OECD, 2012). Therefore, the percentage of students who are tracked to the high-achiever track in Germany is considerably smaller than the percentage of students with an immigration background in the schooling system. It also has to be noted that our study was conducted in predominantly rural areas of the federal state of Bavaria, which might offer another explanation for the low percentage of students with immigration background.

Entire classrooms of regular schools were recruited via the local education authorities. Participation was voluntary, and parents gave their consent. For our study, only those students who had obtained the required grade point average in their report card to be allowed to enter the high-achiever track of the German school system after the completion of the school year were taken into account. We provide more details on achievement requirements below.

3.2. Design and procedure

The study was conducted in the last third of the school year, right after the decisions on how students would be tracked in the following school year were made. Teachers provided information on students' academic achievement; and students filled out a questionnaire on their learning-style preferences, their trait achievement emotions, and their application of cognitive text-reduction strategies. Then, the students' learning processes were examined more closely with task related measures. Keeping learning journals when working on actual learning tasks is one way to measure learning strategies closer to the learning situation (Schmitz & Wiese, 2006; Zimmerman, 2008b). Therefore, students worked on five basic science texts on five subsequent days of one week as part of their regular school work and reported their use of learning strategies in a learning journal. The contents of all texts dealt with basic science. For example, one text was about how dogs hunted their prey, and another text about the structure of the human eye. Altogether, there were five different texts. Every text contained ten main ideas and several distractor sentences. The texts were all of comparable length (about 420 words) and difficulty. The 5 texts received a mean score of 57.20 (*SD* 5.34) on the Flesch Reading Ease index (Flesch & Lass, 1996) in analyses using the tool leichtlesbar by Bachmann (2014). When the scale for

reading ease is adapted to German, this value corresponds to the average difficulty level of texts in secondary school (Bachmann, 2014). This ensured that the texts were challenging enough for high-achieving primary school students to allow them to be able to perceive the application of text-reduction strategies as necessary and beneficial.

Before students started working on the first text, they were asked to set a goal for themselves of how many of the 10 main ideas they aimed to find on average in the daily texts and to note this in their learning journal. Prior to working on each text, students indicated their state emotions with regard to the task. While working on the texts, students were asked to apply text-reduction strategies. After working on the texts, they were asked to report their strategy monitoring into their learning journals. The main ideas of each text were discussed the following day during regular classroom instruction. Students were then asked to indicate their state emotions and to work on the new text. This design not only allowed us to measure learning strategies in a more task-related manner and in close proximity to the learning situation, it also made it possible for us to analyze a sequence in the learning process: students worked on a first task, received feedback on it, and experienced more or less success, which might lead to specific state emotions when they started work at a second similar task, and, maybe, they adjusted their learning strategy during work on this second task. Thus, we were able to examine whether state achievement emotions mediated relationships between more or less successful learning and the subsequent use of learning strategies.

3.3. Measures

Academic achievement and assignment to the high-achiever track

Students' grade point average in the main subjects of mathematics, German (language arts), and basic science served as a measure of academic achievement in this study. It is also used to assign students to the different tracks in the German secondary school system. Yet, it should be noted that in Germany students' grades are highly dependent on students' socio-economic background (Maaz, Baeriswyl, & Trautwein, 2011). In Germany, the best grade possible is 1 and the poorest grade is 6, with a grade of 5 or worse indicating that the classroom goal was not reached. In order to be allowed to enter the high-achiever track, students' grade point average in mathematics, German, and basic science has to be better than 2.33. For easier interpretation, the grades are scaled inversely in the analysis, with 6 indicating the highest possible level of academic achievement. The cut-off value for entrance to the high-achiever track in the reversed scale, therefore, was 4.67.

Questionnaire

Learning style preference. A shortened version (21 of 28 items) of the Fragebogen Selbstreguliertes Lernen–7 (FSL–7) [Questionnaire of Self-Regulated Learning–7] (Ziegler et al., 2010) was used to measure students' learning-style preference. This questionnaire is based on the normative seven-step cyclical model of self-regulated learning by Ziegler and Stoeger (2005) and includes items concerning cognitive and metacognitive learning strategies, namely, self-assessment, goal setting, strategic planning, strategy implementation, strategy monitoring, strategy adjustment, and outcome evaluation. For three different learning situations (preparing for an in-class test, catching up on schoolwork after an illness, and studying for school in general), students are asked to indicate their learning-style preference for each of the seven steps of self-regulated learning by choosing one of three alternatives: self-regulated, externally regulated, or impulsive learning. Sample item for goal setting: "How do you study for school?" (a) "I set a fixed goal for myself describing what and how much I want to study" [self-regulated learning], (b) "My teacher or parents should tell me which goal I should set for myself" [externally regulated learning], and (c) "When studying, I don't set a specific goal for myself. I can rely on my intuition" [impulsive learning]. Cronbach's alpha was .88 for self-regulated learning, .92 for externally regulated learning, and .91 for impulsive learning. In the present study, we were interested in the preference for a given type of learning behavior. Therefore, we counted the number of choices for a given learning alternative (self-regulated, externally regulated, or impulsive). The students with a majority of choices in self-regulated learning were labeled self-regulated learners. Students with a majority of choices in externally regulated learning were labeled externally regulated learners; and those who mostly chose the impulsive learning alternative were labeled impulsive learners. The minimum of choices for one learning style could be 0 and the maximum of choices could be 21.

Preference for self-regulated learning. Students' overall preference for self-regulated learning was measured by calculating an overall score of the frequency with which a student chose the self-regulated learning alternative out of the 21 items in the FSL–7 (Ziegler et al., 2010) and dividing it by the total number of items answered. For easier understanding, the scores are reported as percentages. For example, a student who chose the self-regulated learning option in 9 out of the 21 items would be given a score of 42.86%.

Trait achievement emotions. To assess the trait achievement emotions of enjoyment, anger, boredom, and anxiety when working with texts, emotion measures were adapted from the Achievement Emotions Questionnaire ([AEQ], Pekrun et al., 2011). The emotions of

enjoyment (sample item: “I enjoy working with texts.”), anger (sample item: “I am angry when working with texts.”), boredom (sample item: “Just thinking about working with texts makes me feel bored.”), and anxiety (sample item: “I feel tense and nervous when working with texts.”) were chosen to be assessed, as this selection included (a) positive and negative emotions, (b) emotions that differ with respect to having an outcome versus activity focus, and (c) emotions that seemed to be salient in academic settings (e.g. Pekrun et al., 2002). Each emotion was measured with a six-point Likert scale that ranged from 1 (completely disagree) to 6 (completely agree) and comprised five items. Cronbach’s alpha for enjoyment was .85, for anger .83, for boredom .86, and for anxiety .81.

Application of text-reduction strategies. Whether students used cognitive text-reduction strategies was measured with a four-item scale asking whether students underline important ideas, take notes, draw mind-maps, or write summaries when working with texts (sample item: “When I read a text, I underline its main ideas.”). Answers were assessed on a six-point Likert scale ranging from 1 (completely disagree) to 6 (completely agree). Cronbach’s alpha was at .67.

Task-related measures and learning journal

State emotions. State emotions were measured in the specific learning situation prior to working on the texts and therefore after students received feedback on the previous text they had worked on. Four single-item scales for the respective emotions of enjoyment, anger, boredom, and anxiety were included on students’ worksheets above the expository texts. A sample item measuring the state emotion of anger was “Prior to working on the text I am angry,” with a six-point Likert scale ranging from 1 (completely disagree) to 6 (completely agree) as answer format.

Competence in identifying main ideas. To measure whether students were competent in applying learning strategies effectively, they were asked to work through the five expository texts described above from the domain of basic science and identify as many of the 10 main ideas as possible. The number of correctly identified main ideas of each text was recorded in the learning journal after correction in the classroom. The daily scores were counted and the average score of the five texts served as an indicator of students’ competence in identifying main ideas (with a minimum of 0 and a maximum of 10).

Goal deviance. To measure students’ competence in goal setting, students were asked to set a goal for themselves of how many main ideas they aimed to find on average in the

five texts. Before students set their goal, the first text was read to them, and they were told that all the following texts were of comparable length and difficulty. Students were asked to think about how good they were at working with texts and about the difficulty of the text and then to write down the number of main ideas they aimed to find on average into their learning journal. The deviance between the goals students set at the beginning of the week and the average number of correctly identified main ideas in the five consecutive texts served as an indicator of students' competence in goal setting. Goal deviance was calculated by subtracting the number of correctly identified main ideas from the number of main ideas the students had aimed to find. Negative values in goal deviance indicated that students were successful, as they had surpassed their self-set goal. Positive values in goal deviance indicated that students had failed to achieve their goals.

Strategy monitoring. Students reported their strategy monitoring directly after they had finished working on each text answering a single-item scale ("I monitored myself while I was applying my strategies.") in their learning journal. The scale ranged from 1 (completely disagree) to 6 (completely agree). The average score from the five texts served as an indicator of students' strategy monitoring while working with texts.

4. Results

4.1. Learning-style preferences among fourth graders before their transition to high-achiever track secondary school

The first aim of the present study was to find out which learning style students prefer who will attend the high-achiever track of secondary school after completion of primary school. Of the 200 students in the sample, 33.0% (n = 66) preferred a self-regulated learning style, 18.5% (n = 37) preferred an externally regulated learning style, and 46.5% (n = 93) preferred an impulsive learning style. Two percent (n = 4) could not be clearly assigned to one learning style as they equally preferred either two or all three learning styles. A chi-square test assuming equal variances confirmed the differences in proportions of learning styles ($p < .05$).

4.2. Are learning-style preferences related to trait achievement emotions?

Our second aim was to examine whether students' learning-style preferences were related to their trait emotions. Table 1 presents the descriptive statistics for students' trait achievement emotions and the grade point average for all students and subdivided by their

respective learning-style preferences. The four students who could not be assigned to one learning style were excluded from these analyses.

Table 1

Means and standard deviations for students' trait achievement emotions and their academic achievement for all students and subdivided by their respective learning- style preferences.

Variables	All students		Self-regulated style		Externally regulated style		Impulsive style		F_{univ}	p	Partial η^2
	3.77	1.19	*M*	*SD*	*M*	*SD*	*M*	*SD*			
GPA	2.22	1.03	4.96[a]	0.30	4.86[a]	0.27	5.11[b]	0.41	7.53*	.001	.073
Enjoyment	2.31	1.18	4.20[a]	0.99	3.47[b]	1.29	3.59[b]	1.23	6.79*	.001	.067
Boredom	2.10	0.96	1.82[a]	0.83	2.50[b]	0.97	2.55[b]	1.35	8.52*	.001	.082
Anger	5.01	0.36	1.91	0.84	2.33	1.02	2.34	1.12	3.74	.025	.038
Anxiety	3.71	1.19	2.07	0.89	2.34	0.93	1.99	0.99	1.81	.167	.019

Notes. The Bonferroni-adjusted significance level for the follow-up univariate analyses was .010. Asterisks indicate significant *F-tests* at the Bonferroni-adjusted significance level.
Group means significantly differ between groups which have different superscripts in post hoc analyses using the Scheffé criterion ($p < .05$).

A one-way multivariate analysis of variance was calculated to examine whether the students who preferred different learning styles also differed in their academic emotions of enjoyment, anger, boredom, and anxiety. As emotions may also be related to achievement, students' GPA was included in the analysis as a control variable.

On the basis of Wilk's criterion, the academic emotions were significantly related to learnin-style preference, $F_{mult}(10,372) = 4.42$, $p < .001$, partial $\eta^2 = .106$. Results of univariate *F* tests for learning-style preferences, based on a Bonferroni-adjusted criterion of .010 are presented in Table 1. Differences between the learning styles were found for students' achievement and also for enjoyment and boredom. Post-hoc comparisons using the conservative Scheffé criterion (Tabachnick & Fidell, 2014) showed that students who preferred an impulsive learning style had a significantly higher GPA than students who preferred a self-regulated or externally regulated learning style ($p < .05$). There was no difference in GPA between students who preferred the self-regulated and the externally regulated learning style ($p > .05$). However, the results are different when we examine students' emotions. The students who preferred a self-regulated learning style experienced significantly more enjoyment than students who preferred an externally regulated learning style and students who preferred an impulsive learning style ($p < .05$). Among the latter two groups, there was no difference in enjoyment ($p > .05$). With regard to boredom, students who preferred a self-regulated learning style experienced less boredom than students who

preferred an externally regulated learning style or students who preferred an impulsive learning style ($p < .05$). Again, no difference was found between students who preferred the latter two learning styles ($p < .05$).

4.3. Do students' preference for self-regulated learning and their trait achievement emotions predict the use and quality of learning strategies?

To attain the third aim of the study, we examined whether the degree to which students prefer self-regulated learning in combination with their trait achievement emotions predicts the use of self-regulated learning strategies, namely, the application of cognitive text-reduction strategies and the metacognitive strategies of goal setting and strategy monitoring. Table 2 presents means, standard deviations, and correlations for all variables in the analyses. All correlations were sufficiently low to rule out multicollinearity. No univariate outliers were detected; and an examination of the Mahalanobis distance did not indicate multivariate outliers. In order to examine whether students' preference for self-regulated learning in combination with their achievement emotions predicts use of and competence in applying cognitive and metacognitive strategies, a series of simultaneous multiple regression analyses were performed. In these analyses, the respective cognitive or metacognitive strategy was the dependent variable, while students' preference for self-regulated learning and their emotions, measured as traits, as well as the interaction between preference for self-regulated learning and the respective trait achievement emotions (enjoyment, anger, boredom, and anxiety) served as the independent variables. Students' GPA was also entered into the regression as a control variable. Prior to the analyses, all variables were mean centered (Aiken & West, 1991; Hayes, 2013). Analyses were conducted separately for the different emotions. In all these analyses, the different learning styles were no longer taken into account. Instead, the overall preference for self-regulated learning each student reported was included in the analyses.

Table 2
Means, standard deviations and correlations.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. SRL-preference	0.364 (36.4%)	0.266	—								
2. Enjoyment	3.766	1.193	.229**	—							
3. Anger	2.209	1.035	-.251**	-.685**	—						
4. Boredom	2.313	1.183	-.278**	-.679**	.791**	—					
5. Anxiety	2.101	0.964	-.087	-.466**	.605**	.377**	—				
6. GPA	5.008	0.362	-.010	.236**	-.274**	-.177*	-.338**	—			
7. Goal deviance	-0.907	1.560	.097	.030	.020	.011	.026	.102	—		
8. Text-red. strategies	2.555	0.944	.184**	.105	.074	-.012	.117	-.066	.010	—	
9. Competence in main ideas	7.451	0.908	-.019	.219**	-.158*	-.171*	-.188**	.171*	-.375**	.154*	—
10. Strategy monitoring	4.294	1.213	.300**	.129	-.052	-.127	-.059	.069	.120	.174*	.068

N = 200
*p < .05 ** p < .001

4.4. Application of cognitive text-reduction strategies and the relation to preference for self-regulated learning and trait achievement emotions

We examined students' application of cognitive text-reduction strategies. Simultaneous multiple regression analysis was conducted, as outlined above, with students' preference for self-regulated learning, the achievement emotion of enjoyment, and the interaction term between preference for self-regulated learning and enjoyment as predictor variables and students' application of cognitive text-reduction strategies as the dependent variable. Students' GPA was entered as a control variable. The same analysis was repeated for the emotions of anger, boredom, and anxiety.

The results of the regression analyses for the four different emotions are displayed in Table 3. Students' preference for self-regulated learning was the only significant predictor for the application of text-reduction strategies in each regression ($p < .05$). The significant positive effect of preference for self-regulated learning on the application of text-reduction strategies means that the more students preferred self-regulated learning, the more they reported using cognitive text-reduction strategies, independent of their emotions. Students' emotions neither predicted the use of cognitive text-reduction strategies alone nor in interaction with the preference for self-regulated learning.

Table 3
Results from simultaneous multiple regression analyses with application of text-reduction strategies as criterion.

	ENJOYMENT				ANGER			
Variable	**B**	**SE B**	**β**	**R^2adj**	**B**	**SE B**	**β**	**R^2adj**
				.035*				.036*
GPA	-.275	.192	-.106		-.116	.193	-.044	
Preference for SRL	.643	.260	.181*		.820	.264	.231*	
Emotion	.057	.059	.072		.124	.071	.136	
Preference for SRL x Emotion	-.312	.225	-.102		.278	.269	.077	

	BOREDOM				ANXIETY			
Variable	**B**	**SE B**	**β**	**R^2adj**	**B**	**SE B**	**β**	**R^2adj**
				.039*				.033*
Grades	-.233	.190	-.089		-.063	.196	-.024	
Preference for SRL	.817	.268	.230*		.702	.254	.198*	
Emotion	.049	.060	.061		.125	.074	.128	
Preference for SRL x Emotion	.495	.246	.151		.064	.308	.015	

*p < .05

4.5. Competence in identifying main ideas and the relation to preference for self-regulated learning and trait achievement emotions

In the next step, we focused on students' actual competence in applying text-reduction strategies to identify main ideas in texts. Therefore, competence in identifying main ideas served as the dependent variable in the multiple regression analyses, while the independent variables stayed the same as in the previous analyses. To follow up on moderator effects, the SPSS macro PROCESS (http://www.afhayes.com; Hayes, 2013) was used. The results of the analyses are displayed in Table 4.

Table 4
Results from simultaneous multiple regression analyses with competence in identifying main ideas as criterion.

	ENJOYMENT				ANGER			
Variable	**B**	**SE B**	**β**	**R²adj**	**B**	**SE B**	**β**	**R²adj**
				.066**				.055**
GPA	.204	.182	.083		.230	.184	.093	
Preference for SRL	-.094	.248	-.028		-.013	.254	-.004	
Emotion	.141	.057	.186*		-.083	.068	-.095	
Preference for SRL x Emotion	-.453	.216	-.153*		.661	.257	.192*	

	BOREDOM				ANXIETY			
Variable	**B**	**SE B**	**β**	**R²adj**	**B**	**SE B**	**β**	**R²adj**
				.055**				.073**
GPA	.245	.181	.099		.194	.186	.079	
Preference for SRL	-.044	.257	-.013		.037	.241	.011	
Emotion	-.098	.058	-.130		-.125	.070	-.134	
Preference for SRL x Emotion	.529	.235	.169*		.899	.293	.220**	

*p < .05 ** p < .01

Again, significant models emerged for all four analyses on the different emotions ($p < .01$). In the analysis that included enjoyment, there was a significant main effect of enjoyment $t(191) = 2.50$, $p = .01$ ($\beta = .19$), which suggested that students who reported high enjoyment identified more main ideas correctly. However, the interaction effect between preference for self-regulated learning and enjoyment turned out to be significant as well $t(191) = –2.09$, $p = .04$ ($\beta = –.15$), so the role of enjoyment in predicting the competence in identifying main ideas can only be interpreted in combination with the preference for self-regulated learning. To follow up on this interaction effect, and to be able to interpret its

result, the SPSS macro PROCESS (Hayes, 2013) was used to perform analyses similar to the simple slopes analysis suggested by Aiken and West (1991), and also described in Cohen (2003). This procedure involves selecting a value or values of the moderator, which in our analyses was the respective emotion of enjoyment, anger, boredom, or anxiety, and then calculating the conditional effect of the independent variable (i.e. preference for self-regulated learning) on the dependent variable (i.e. competence in identifying main ideas) at those values, using an inferential test. The typical values selected for calculating the conditional effects are one standard deviation above and one standard deviation below the mean. We followed this example in all analyses in our study and conducted simple slope analyses, regressing students' preference for self-regulated learning on their competence in identifying main ideas when students' enjoyment (anger, boredom, or anxiety) was set at one standard deviation above and one standard deviation below the mean. Simple slope analyses showed that when enjoyment is at a higher level (+ 1 *SD*), there was a significant negative relationship between the preference for self-regulated learning and competence in identifying main ideas (simple slope of $B = -0.63$, $SE = 0.29$, $p = .03$). No significant relationship between the preference for self-regulated learning and competence was detected for a lower level (–1 *SD*) of enjoyment (simple slope of $B = 0.44$, $SE = 0.43$, $p = .30$). This means that students who experienced a higher level of enjoyment identified significantly fewer main ideas the more they preferred self-regulated learning. Figure 1 depicts this result for enjoyment as well the results from simple slope analyses for the emotions of anger, boredom, and anxiety. In these analyses we proceeded similarly; and the results will be briefly described below.

In the multiple regression analysis that included the emotion of anger, only the interaction effect between preference for self-regulated learning and anger turned out to be significant ($p < .05$). Simple slope analyses did not indicate a significant relationship between the preference for self-regulated learning and competence in identifying main ideas when anger was at a higher level ($p > .05$). For a lower level of anger, the relationship was significantly negative ($p < .05$). This meant that students who experienced a lower level of anger identified significantly fewer main ideas the more they preferred self-regulated learning.

As in the analysis including anger, the interaction effect between preference for self-regulated learning and the respective emotion significantly predicted the competence in finding main ideas ($p < .05$) in the analyses including boredom and anxiety. With regard to boredom, simple slope analyses did not find a significant relationship when boredom was at

a higher level ($p > .05$), while for a lower level of boredom the relationship was significantly negative ($p < .05$). As it was the case for the emotion of anger, students who experienced a lower level of boredom identified significantly fewer main ideas the more they preferred self-regulated learning. With regard to anxiety, simple slope analyses for the different levels of anxiety showed a significant positive relationship between the preference for self-regulated learning and the competence in identifying main ideas for a higher level of anxiety ($p < .05$) and a significant negative relationship between these constructs for a lower level of anxiety ($p < .05$). Students who experienced a higher level of anxiety identified significantly more main ideas the more they preferred self-regulated learning, while students who experienced a lower level of anxiety identified significantly fewer main ideas the more they preferred self-regulated learning.

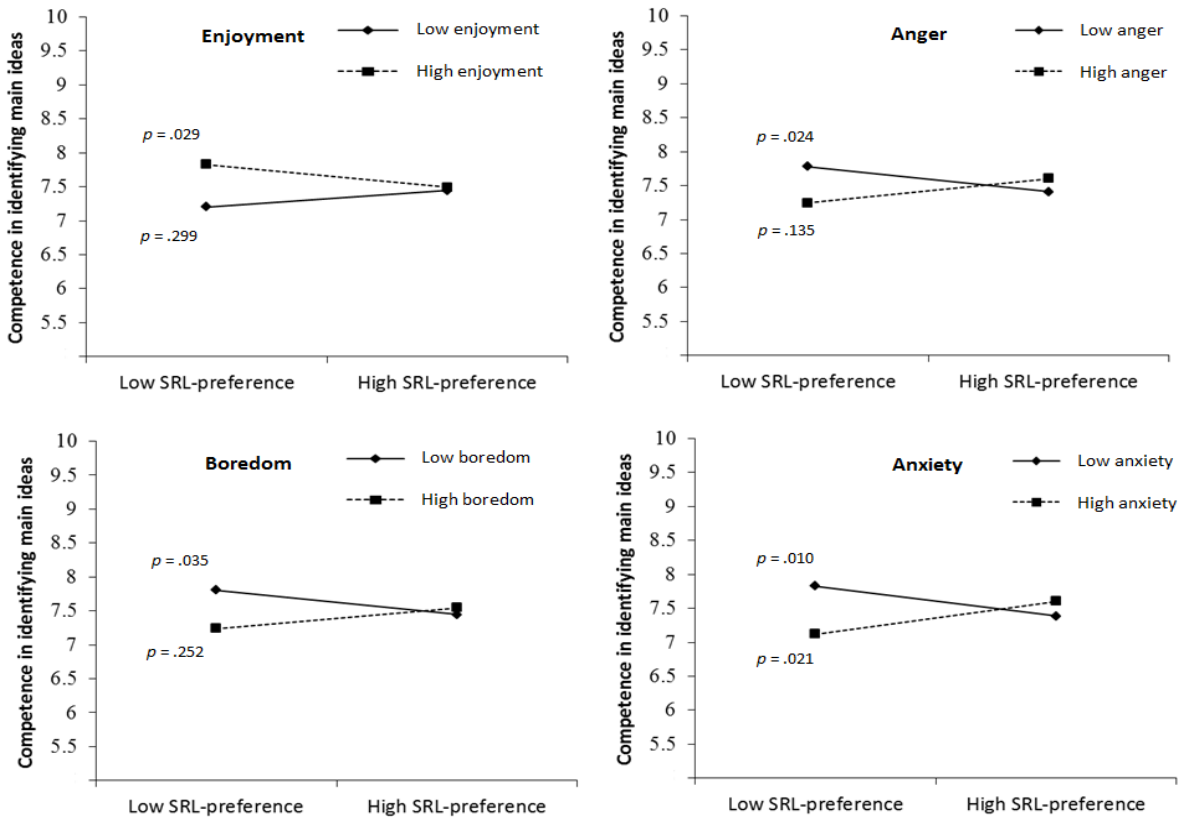

Figure 1. Interactions between students' preference for self-regulated learning and separate emotions as predictors of competence in identifying main ideas.

4.6. Goal setting and the relation to preference for self-regulated learning and trait achievement emotions

As setting goals is an important metacognitive strategy that should be used prior to any learning activity, we examined students' competence in goal setting. Goal deviance was used as an indicator of this competence. Overall, 44.3% of the students (n = 85) neither surpassed their goal by more than one main idea nor did they fall short of their goal by more than one main idea, which means that they had set appropriate goals. 9.4% of the students (n = 18) had set goals that were too high, identifying more than one main idea less than they aimed to. 46.4% of the students (n = 89) set their goals too low, meaning they identified more than one main idea more than they aimed to. A multinomial logistic regression did not yield significant results in predicting the three different groups of students (i.e. those who had set their goals too high, set them too low, or set them close to their actual competence level) with the help of students' preference for self-regulated learning, their emotions, and the respective interactions. For this reason, we tried to predict the average goal deviance by students' preference for self-regulated learning, their emotions, and the respective interactions as independent variables using simultaneous multiple regression. Goal deviance was therein used as a continuous variable. A closer look at this continuous measure showed that, on average, students had underestimated their competencies in finding main ideas, meaning that, on average, they were setting goals that were too low (M = –0.91, SD = 1.56). Following the practice of previous analyses regarding the application of cognitive learning strategies and competence in identifying main ideas, we conducted separate analyses for the emotions of enjoyment, anger, boredom, and anxiety. Students' GPA was always included as control variable and all variables were mean centered. The results of the analyses are displayed in Table 5; interaction effects are visualized in Figure 2.

All four regression models for the respective emotions significantly predicted goal deviation (p < .05). Our results showed a significant effect for the control variable achievement (GPA). It significantly predicted students' goal deviance (p < .05). The higher the students' grades, the more appropriate were the goals they set on average. In all models, the interaction between preference for self-regulated learning and the respective emotion was significant (p < .05).

With regard to enjoyment, simple slope analyses found that when enjoyment was at a higher level, there was a significant positive relationship between the preference for self-regulated learning and goal deviance (p < .01). When enjoyment was at a lower level, there was a marginally significant negative relationship between students' preference for self-regulated learning and their goal deviance (p < .10). Students who experienced a higher level

of enjoyment and who had a higher preference for self-regulated learning deviated less from their goal on average and were better at goal setting.

Table 5
Results from simultaneous multiple regression analyses with goal setting as criterion.

	ENJOYMENT				ANGER			
Variable	**B**	**SE B**	**β**	**R^2adj**	**B**	**SE B**	**β**	**R^2adj**
				.051**				.051**
GPA	.654	.319	.154*		.688	.321	.162*	
Preference for SRL	.325	.433	.056		.394	.442	.068	
Emotion	.016	.099	.012		.054	.117	.036	
Preference for SRL x Emotion	1.218	.378	.240**		-1.358	.446	-.230**	

	BOREDOM				ANXIETY			
Variable	**B**	**SE B**	**β**	**R^2adj**	**B**	**SE B**	**β**	**R^2adj**
				.068**				. 036*
Grades	.712	.312	.167*		.661	.329	.155*	
Preference for SRL	.254	.443	.044		.423	.426	.073	
Emotion	.010	.099	.008		.107	.124	.067	
Preference for SRL x Emotion	-1.484	.406	-.276***		-1.311	.517	-.187*	

*p < .05 ** p < .01 *** p < .001

Looking at the results including anger, simple slope analyses showed that when students experienced a higher level of anger, the relation between preference for self-regulated learning and goal deviance was not significant ($p > .05$). Though, at a lower level of anger, there was a significant positive relationship between the preference for self-regulated learning and goal deviance ($p < .01$). Students who experienced a lower level of anger deviated on average less from their goals when their preference for self-regulated learning was high.

Simple slope analyses following up on the interaction between preference for self-regulated learning and boredom showed that at a higher level of boredom there was a significantly negative relationship between preference for self-regulated learning and goal deviance ($p < .05$). At a lower level of boredom, there was a significantly positive relationship between preference for self-regulated learning and goal deviance ($p < .001$). This implies that students who experienced a higher level of boredom set less appropriate

goals on average when their preference for self-regulated learning was high. Students who experienced a lower level of boredom set more appropriate goals on average when their preference for self-regulated learning was high.

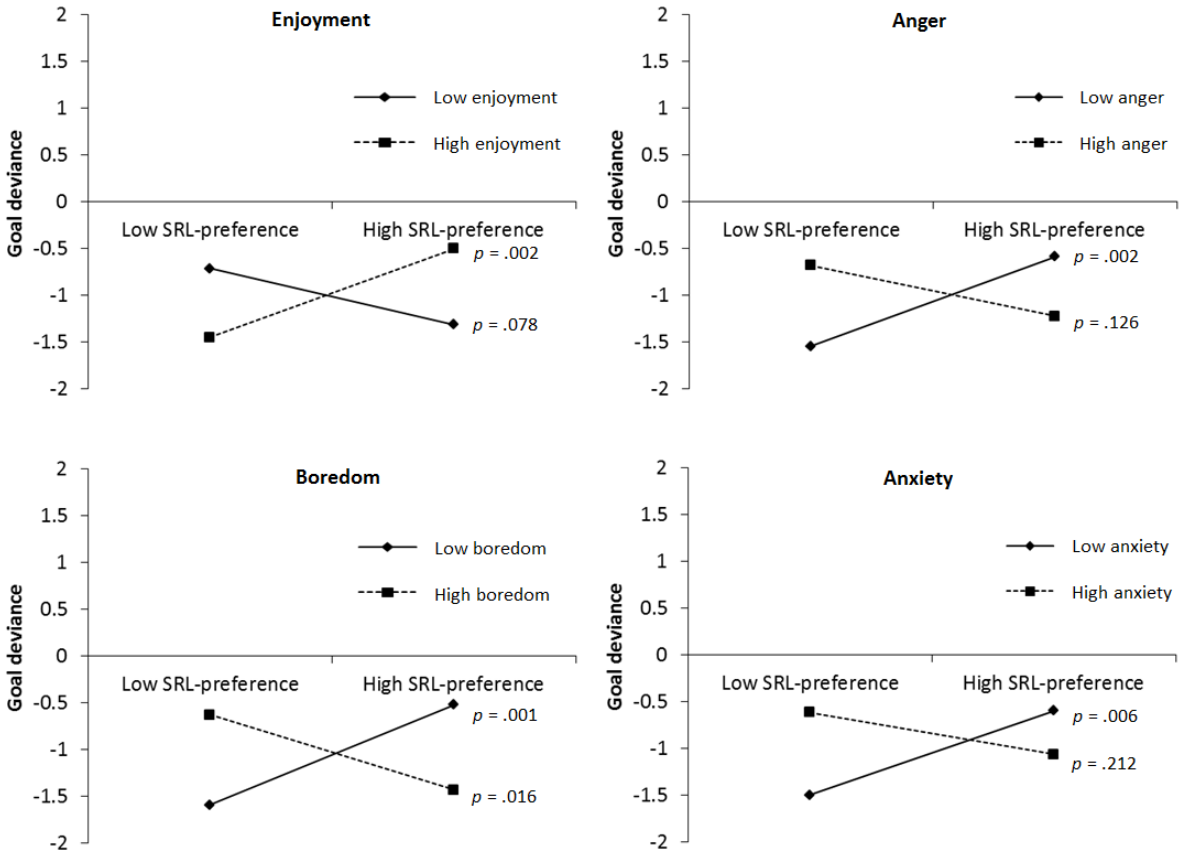

Figure 2. Interactions between students' preference for self-regulated learning and separate emotions as predictors of goal deviance. Scores closer to zero indicate smaller goal deviance.

Finally, the same analyses were also performed for the emotion of anxiety. When students experienced a higher level of anxiety, there was no significant relation between preference for self-regulated learning and goal deviance ($p > .05$). However, when students experienced a lower level of anxiety, there was a significant positive relationship between preference for self-regulated learning and goal deviance ($p < .01$). Students who experienced a lower level of anxiety deviated less from their goals on average when their preference for self-regulated learning was high.

4.7. Strategy monitoring and the relation to preference for self-regulated learning and trait achievement emotions

Strategy monitoring is another metacognitive strategy that helps students to successfully self-regulate their learning. In order to find out whether students' preference for self-regulated learning and their emotions were related to students' strategy monitoring, simultaneous multiple regression analyses were conducted, in a manner similar to those in previous analyses, with students' strategy monitoring as the dependent variable. The results are displayed in Table 6. All regression models done separately for the different emotions were statistically significant ($p < .01$). As was the case with application of text-reduction strategies, students' preference for self-regulated learning was the only significant predictor for strategy monitoring in each regression ($p < .001$). This means that the more students preferred self-regulated learning, the more they monitored their learning. Neither students' emotions, nor the interaction term of emotions and preference for self-regulated learning or their GPA predicted their use of the metacognitive strategy of monitoring.

Table 6
Results from simultaneous multiple regression analyses with strategy monitoring as criterion.

	ENJOYMENT				ANGER			
Variable	**B**	**SE B**	**β**	**R^2adj**	**B**	**SE B**	**β**	**R^2adj**
				.079**				.072**
GPA	.250	.243	.075		.299	.245	.090	
Preference for SRL	1.195	.331	.262***		1.345	.339	.295***	
Emotion	.065	.075	.064		.049	.090	.042	
Preference for SRL x Emotion	.356	.289	.090		-.181	.344	-.039	

	BOREDOM				ANXIETY			
Variable	**B**	**SE B**	**β**	**R^2adj**	**B**	**SE B**	**β**	**R^2adj**
				.071**				.070**
Grades	.195	.241	.059		.244	.250	.074	
Preference for SRL	1.297	.344	.285***		1.290	.325	.283***	
Emotion	-.035	.077	-.035		-.011	.094	-.009	
Preference for SRL x Emotion	.089	.319	.021		-.223	.393	-.041	

** p < .01 *** p < .001

4.8. Do state achievement emotions mediate relationships between success in learning and subsequent learning behavior?

The fourth aim of our study was to find out whether goal deviance (as an operationalization of success or failure in the learning process) influences state emotions and whether goal deviance, mediated by these state emotions, led to changes in students' learning behavior, namely, to an increase in the metacognitive strategy of monitoring. To analyze these relationships, we focused on the first two texts. We examined students' goal deviance (operationalized by the difference between the goal set at the beginning of the week [number of main ideas the students aimed to find] and the number of correctly identified main ideas in text 1) and the effect of this goal deviance on students' state emotions as well as on the resulting strategy monitoring when working on text 2. We assumed that students experienced failure if they did not identify as many main ideas correctly as they had aimed to. According to our operationalization of goal deviance, failure was therefore represented by a positive value for goal deviance. A value of zero showed that students had reached their goal, and a negative value of goal deviance represented success. In separate analyses, the four state emotions of enjoyment, anger, boredom, and anxiety were examined as a mediator for the influence of students' goal deviance in text 1, which served as the independent variable, on students' strategy monitoring in text 2. Figure 3 depicts the schematic model for all analyses and includes results for the analysis on state anger. Students' GPA, their preference for self-regulated learning, their respective trait emotions, and their strategy monitoring during text 1 were included in the analyses as control variables. The formal assessment of mediation was conducted using the SPSS macro PROCESS (Hayes, 2013) using ordinary least squares path analysis. Bias-corrected bootstrap confidence intervals for indirect effects were calculated for 10,000 bootstrap samples as recommended in Hayes (2013).

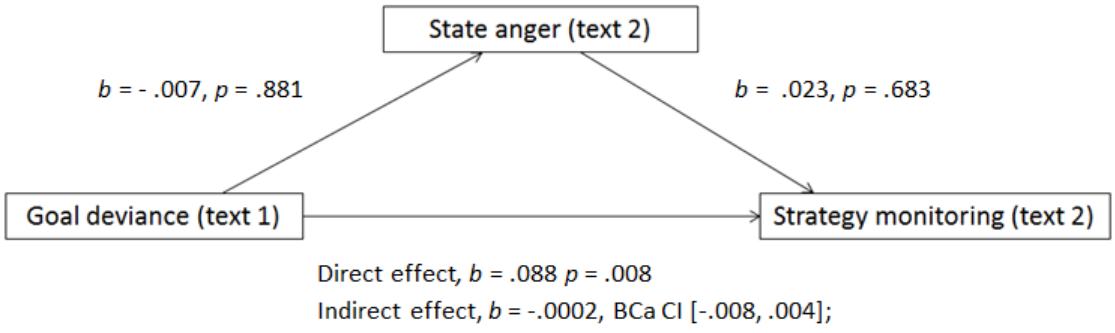

Figure 3. Test of a mediation model for goal deviance, state emotions and learning behavior.

The means and standard deviations for the state measures from text 1 and text 2 included in the mediation analyses are given in Table 7. The overall results provided in Table 8 showed that students' goal deviance in text 1 did not predict students' state emotions in text 2, neither for enjoyment, nor for anger, boredom, or anxiety, when students' GPA, their preference for self-regulated learning, their respective trait emotions, and their strategy monitoring in text one were controlled for. There was no significant indirect effect of goal deviance on subsequent strategy monitoring through any of the four state emotions we investigated (enjoyment: b = –.0001, BCa CI [–.010, .006]; anger: b = –.0002, BCa CI [–.008, .004]; boredom: b = –.0000, BCa CI [–.008, .006]; anxiety: b = –.0003, BCa CI [–.011, .005]). Thus state emotions that arose after students learned about their goal deviance did not significantly influence their immediate learning behavior in terms of strategy monitoring. However, each of the analyses showed that there was a significant direct effect of goal deviance on subsequent strategy monitoring ($p < .001$). The higher the level of goal deviance, that is, the more students had fallen short of their goal and experienced failure, the more students reported monitoring their strategy use the following day.

Table 7
Mean values and standard deviations for the state measures from text 1 and text 2 included in the mediation analyses

Variable	*M*	*SD*
Goal deviance text 1	-0.090	1.953
Strategy monitoring text 1	4.130	1.292
Strategy monitoring text 2	4.420	1.33
State enjoyment text 2	4.020	1.527
State anger text 2	1.690	1.245
State boredom text 2	2.010	1.368
State anxiety text 2	1.430	0.981

Table 8

Results from multiple regression analyses of strategy monitoring on goal deviance including mediation analyses of state emotions

	ENJOYMENT		ANGER		BOREDOM		ANXIETY	
Variable	**State emotion text 2**	**Strategy monitoring text 2**	**State emotion text 2**	**Strategy monitoring text 2**	**State emotion text 2**	**Strategy monitoring text 2**	**State emotion text 2**	**Strategy monitoring text 2**
Goal deviance text 1	-0.004 (0.059)	0.092** (0.033)	-0.007 (0.049)	0.088** (0.033)	0.000 (0.051)	0.090** (0.033)	-0.043 (0.041)	0.089** (0.034)
State emotion text 2	—	0.033 (0.046)	—	0.023 (0.055)	—	-0.020 (0.053)	—	0.034 (0.068)
GPA	-0.048 (0.312)	-0.181 (0.177)	-0.290 (0.266)	-0.159 (0.179)	-0.323 (0.268)	-.0223 (0.175)	-0.231 (0.223)	-0.172 (0.184)
Preference for SRL	0.442 (0.449)	0.484† (0.255)	0.074 (0.393)	0.511† (0.263)	-0.096 (0.409)	0.450† (0.265)	0.125 (0.311)	0.465† (0.257)
Trait emotion	0.456*** (0.103)	-0.040 (0.062)	0.149 (0.100)	0.052 (0.068)	0.440*** (0.092)	0.002 (0.064)	0.234** (0.088)	0.022 (0.075)
Strategy monitoring text 1	0.226* (0.097)	-0.203*** (0.056)	-0.112 (0.081)	0.811*** (0.055)	-0.238** (0.084)	0.802*** (0.056)	0.011 (0.067)	0.810*** (0.055)
Constant	1.350 (1.565)	1.831* (0.888)	3.259* (1.461)	1.478 (0.995)	3.738* (1.457)	2.010* (0.967)	2.011 (1.247)	1.617 (1.038)
	$R^2 = 0.182$ F (5, 149) = 6.613, $p < .001$	$R^2 = 0.141$ F (6, 148) = 4.043, $p = .001$	$R^2 = 0.047$ F (5, 149) = 1.484 $p = .198$	$R^2 = 0.646$ F (6, 148) = 44.920, $p < .001$	$R^2 = 0.226$ F (5, 149) = 8.705, $p < .001$	$R^2 = 0.644$ F (6, 148) = 44.589, $p < .001$	$R^2 = 0.077$ F (5, 149) = 2.492, $p = .034$	$R^2 = 0.645$ F (6, 148) = 44.715, $p < .001$

*$p < .05$ ** $p < .01$ *** $p < .001$

5. Discussion

In this study, the majority of students who would attend the high-achiever track of secondary school did not prefer a self-regulated learning style over an externally regulated or impulsive learning style. Students' learning-style preferences were related to their trait achievement emotions of enjoyment and boredom. Furthermore, students' preference for self-regulated learning in combination with their trait achievement emotions predicted the use and the quality of cognitive and metacognitive learning strategies. State emotions did not mediate the relation between more or less successful learning and subsequent strategy monitoring. However, the more students deviated from their goals and experienced failure, the more they monitored their strategy use when working on the next learning task.

5.1. Missing preference for a self-regulated learning style

With regard to students' lack of preference for a self-regulated learning style, our assumption was corroborated. One explanation for this might be that high-achieving students might not be challenged enough during primary school. Lacking sufficient challenges, such students never experience a situation in which successful learning is dependent upon self-regulated learning. Even without applying the cognitive and metacognitive learning strategies that are of relevance in self-regulated learning, these strong students might achieve the grades required for the transition to high-achiever track secondary school. Therefore, not using learning strategies might be the most efficient approach for them (cf. Rabinowitz, Freeman, & Cohen, 1992). However, the missing preference for self-regulated learning might become a problem as soon as students are faced with more challenging learning contexts in high-achiever track secondary school (e.g. Bong & Skaalvik, 2003; Marsh, 1992; Marsh, Trautwein, Lüdtke, Baumert, & Köller, 2007).

Another explanation might be that students often fail to realize which strategies work well for them and how effectively they apply them (Hunter-Blanks, Ghatala, Pressley, & Levin, 1988). A third possible explanation, that has not been as intensely researched, relates to students' emotions. Rabinowitz et al. (1992) suggested that students might not use a strategy, even if they know it is effective, because they do not enjoy using it. For this reason, we analyzed the relationships between trait achievement emotions and learning-style preferences.

5.2. Relation between students' learning-style preferences and their trait achievement emotions

Students who preferred a self-regulated learning style experienced significantly more enjoyment and less boredom than students who preferred an external or impulsive learning style. These results corroborated our assumptions. Studies showed positive relationships between enjoyment and the use of cognitive and metacognitive strategies (e.g. Ahmed et al. 2013) and negative relationships between boredom and the use of learning strategies (e.g. Goetz & Hall, 2014; Tze et al., 2015). It could be assumed that due to the activating nature of enjoyment and the deactivating nature of boredom (Pekrun, 2006), students who enjoy learning more and are less bored also prefer a self-regulated learning style, in which they have to be active themselves and cannot leave decisions about their learning behavior up to others or skip reflecting and planning altogether. A further explanation for the relationships we found could be that the learning style influences students' emotions and that being an active agent in one's learning process enhances enjoyment and reduces boredom. Bidirectionality might be an issue here. However, our correlational results do not allow for any causal implications.

Results regarding students' academic achievement and their learning-style preferences lend support to the interpretation that high-achieving students might not be challenged during primary school to the point at which they *need* self-regulated learning for successful learning: Academic achievement was higher among students who preferred an impulsive learning style compared to students who preferred a self-regulated or an externally regulated learning style. However, the emotions were more positive and less negative among students who preferred a self-regulated learning style. Given that research had found emotions and performance (e.g. Lichtenfeld et al., 2012) but also emotions and learning strategies to be related (e.g. Pekrun et al., 2011), an interpretation for our finding could be that students' emotions are more closely related to their learning-style preferences than to performance.

5.3. Prediction of learning strategies with preference for self-regulated learning in combination with trait achievement emotions

For the application of cognitive text-reduction strategies and the metacognitive strategy of strategy monitoring, only students' preference for self-regulated learning was predictive. The more students preferred self-regulated learning, the more they reported using text-reduction strategies and strategy monitoring. Their competence in identifying main ideas and goal setting, however, were predicted by the interaction of students' preference for

self-regulated learning and their achievement emotions. It could be assumed that the interaction between emotions and the preference for self-regulated learning did not turn out to be predictive for the application of text-reduction strategies and strategy monitoring, because these constructs both had been measured with self-reports, while competence in identifying main ideas and goal setting had been measured closer to students' learning behavior. Self-reports on learning strategies are often distorted, especially when students are very young (Artelt, 2000) and might for this reason not be related to students' emotions. Another reason could be that the effects of emotions might not have become relevant in self-reported aspects of learning-strategy use. As in these situations, students did not need to become active agents in their learning process and therefore perceived less control and subjective value, both antecedents of achievement emotions, are less influential (Goetz, Pekrun, Hall, & Haag, 2006; Pekrun, 2006).

Regarding competence in identifying main ideas and in contrast to our assumptions (e.g. Ahmed et al., 2013; Pekrun et al., 2011; Tze et al., 2015; Veenman et al., 2000), a high level of enjoyment as well as a low level of anger, boredom, or anxiety, were associated with a lower level of competence in identifying main ideas when students had a high preference for self-regulated learning compared to students who experienced the same emotions but had a low preference for self-regulated learning. An explanation for these results could be that a preference for self-regulated learning might not be enough to apply the learning strategies that are related to self-regulated learning in a competent way. Findings by Obergriesser and Stoeger (2015) also point in this direction. Gifted underachieving students in their sample had reported using cognitive learning strategies more often than gifted achievers, yet, they applied these strategies less competently than their achieving classmates. Students might prefer self-regulated learning, but they might not yet have proceduralized the knowledge necessary for a competent application of learning strategies. Furthermore, positive affective states (represented by high enjoyment and low anger, boredom, and anxiety) might lead students to pay less attention to detail, as mood research has reported that people in positive moods make more errors than people in negative moods (Oaksford, Morris, Grainger, & Williams, 1996).

Students who experienced a higher level of anxiety displayed a better competence in identifying main ideas when they preferred self-regulated learning to a higher extent than students who expressed a low level of preference for self-regulated learning. Here, a high preference for self-regulated learning seemed to compensate for the negative effects of high anxiety to some extent. While anxiety is supposed to go along with avoidance behavior

(Bandura, 1977; Carver & Harmon-Jones, 2009), a preference for self-regulated learning might reduce avoidance tendencies which could interfere with the application of learning strategies. Another, more general interpretation for the findings on students' competence in identifying main ideas could be that the preference for self-regulated learning had an attenuating effect on the relation between students' achievement emotions and their competence in identifying main ideas. More research will be required, however, before conclusions may be drawn. Taking into account students' preference for self-regulated learning adds further information on the relation between achievement emotions and learning strategies.

With regard to the metacognitive strategy of goal setting, the results corroborate our assumptions (e.g. Artino & Jones, 2012; Pekrun et al., 2002; Stewart et al., 2014). For students who experienced high enjoyment, low anger, low boredom, or low anxiety, the combination with a high preference for self-regulated learning was beneficial, as these students deviated less from their goal on average and were better at goal setting than students who experienced the same emotions but had a low preference for self-regulated learning. Less straightforward, however, was the finding that students who experienced a higher level of boredom set less appropriate goals on average when their preference for self-regulated learning was high. One could assume that here the negative relationship between boredom and effort (Jarvis & Seifert, 2002; Pekrun et al., 2010) comes into play and interacts with self-regulated learning. When boredom is high and students prefer to set their own goals, they might also prefer to put less effort into learning, which could lead them to set goals which are easily achievable and therefore too low. Further research on this effect is needed, however, before conclusions from this finding can be drawn. In line with studies on relationships between metacognitive strategies and performance (Bandura & Schunk, 1981; Zimmerman & Kitsantas, 1999), the higher students' achievement was in our study, the better these students were on average at goal setting.

5.4. No mediation of state emotions on the relationships between more or less successful learning and subsequent strategy monitoring

Goal deviance did not predict students' state emotions of enjoyment, anger, boredom, or anxiety, and no mediation effect of state emotions on the relation between more or less successful learning and subsequent strategy monitoring could be found. One explanation for the missing effect of failure on state emotions might be that achieving their goals might have not been important enough for students, as they knew that the competence they displayed

would not be taken into account in their grades. Subjective value, however, is one important antecedent for the elicitation of achievement emotions (Goetz et al., 2006; Pekrun, 2006). Furthermore, the average deviance from students' goals was very small and therefore might not have represented a big enough failure for students to influence their state emotions. The missing influence of students' state emotions on strategy monitoring might be explained by the fact that students' strategy monitoring in general was high and the variance quite small. Furthermore, one could assume that state emotions have a smaller impact on learning behavior than trait emotions, which were examined in the other aims of our study. This assumption is backed by findings demonstrating that emotional traits are stronger predictors of future behavior than emotional states (Wilson & Gilbert, 2005; Wirtz, Kruger, Scollon, & Diener, 2003).

Although no mediation effect of emotions was found with regard to state emotions, there was a significant direct effect of students' goal deviance in text 1 on their strategy monitoring in text 2. The more students deviated from their goals and experienced failure, the more they monitored their strategy use when working on the next learning task. It seemed that even a slight experience of failure had made students aware of flaws in their learning process which they sought to detect and overcome by monitoring their learning process more closely. This is in line with self-regulated learning behavior (e.g. Zimmerman, 2000).

5.5. Limitations and future directions

There are, of course, several limitations to this study. First, the proportion of variance explained by students' preference for self-regulated learning and the single achievement emotions of enjoyment, anger, boredom, and anxiety was rather small and ranged between 3.3 and 7.9%. In general, the proportion of variance in learning behavior explained by emotions alone or, as in our case, by the interaction of emotions and the preference for self-regulated learning, could not be expected to be very high, as numerous other internal and external factors contribute to students' learning. For example, in a study by Multon, Brown, and Lent (1991), students' self-efficacy accounted for 14% of variance in learning and achievement. Furthermore, environmental factors such as parental involvement (Jeynes, 2005), classroom management (Marzano, 2000), and the quality of teaching (Hattie & Clinton, 2008) have important effects on learning as well.

Another limitation in our study is that we looked at the effects of single achievement emotions on learning behavior. The results might have been different if combinations of different achievement emotions and also their interactions had been taken into account.

Though, as this is the first study that takes into account students' preference for self-regulated learning in interaction with achievement emotions, we were interested in the relationships between the preference for self-regulated learning and the individual achievement emotions. Future studies should consider several achievement emotions simultaneously and interactions between them.

Furthermore, it is not clear whether our results can be transferred to other educational contexts. The German school system is special with its characteristic of tracking students as of secondary schooling (usually starting in fifth grade) according to their academic achievements in fourth grade. Although students are still very young in fourth grade, the pressure to achieve is especially high. These environmental characteristics might have a strong impact on students' emotions and their learning-style preferences. Additionally, we examined a special group of students within this tracking school system, namely, those students whose academic achievement was good enough in fourth grade to secure themselves access to high-achiever track secondary school in the subsequent school year. Further studies should be conducted that examine the relationships between students' achievement emotions, their learning-style preferences and their learning behavior for a broader range of achievement levels. It also might be interesting to take a closer look at low-achieving students, as for these students negative emotions such as anger and anxiety might play a bigger role.

Another limitation can be seen in the fact that students knew (a) that they were participating in a study and (b) that the tasks they were asked to work on would not influence their grades and they did not have to expect any consequences. Their emotions and also their learning behavior might be different in learning situations which are more relevant to them. As it has been discussed before, a lack of relevance might also have been an issue in the analyses of students' state emotions and their subsequent learning behavior and also in the analyses of the metacognitive strategy of goal setting. In the first text and also in the weekly average, goal deviation was small. In future studies, another measure should be used, which better depicts success and failure in the learning process of high-achieving students and which differentiates better with regard to goal setting competence and includes all defining criteria of good goals.

Future studies should also look at changes in students' learning-style preferences. Would changes in students' learning-style preferences lead to changes in trait achievement emotions? Furthermore, can interventions to foster self-regulated learning among students also change their achievement emotions? More research on students' state emotions and their

influence on the use of learning strategies is also desirable. Under which conditions, for example, might state emotions influence whether and how students use learning strategies? Knowledge about these relationships might be of help for teachers when trying to enhance learning strategies among students.

5.6. General conclusion and implications

In summary, this study is the first study that examined students' achievement emotions in combination with students' learning-style preferences. Achievement emotions were shown to be related to learning-style preferences of students who were set to enter high-achiever track secondary school in Germany. As preferences might transform into students' study habits in the long run, the importance of achievement emotions should not be underestimated. When teachers try to foster self-regulated learning among students, they should also pay attention to students' achievement emotions and their preference for this learning style, as these factors seem to influence students' learning strategy implementation.

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IV Artikel 3

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Table of contents

The role of emotions, motivation, and learning behavior in underachievement and results of an intervention

Abstract

Research has shown that various individual factors play an important role in the underachievement of gifted students. Most often discussed as predictors of underachievement are motivation, learning behavior, and emotions. To examine which specific constructs from these fields simultaneously predict underachievement among gifted fourth graders, logistic regression was performed on data from eighty-five highly intelligent students out of thirty-four classrooms. Students reported on their self-efficacy, learning goal orientation, use of text strategies, anxiety, boredom, anger, and enjoyment. Emerging predictors of underachievement were self-efficacy, use of text-reduction strategies, and anxiety. As these constructs are all connected to self-regulated learning in different ways, an intervention was implemented which successfully encourages self-regulated learning among students of differing cognitive abilities. Assessing the intervention's effectiveness for different ability levels was important as the intervention was not a pull-out program but was integrated into regular classroom instruction in which all students in these classes participated. Results from multilevel longitudinal models showed positive intervention effects for learning behavior among gifted underachievers, but no intervention effects on self-efficacy and anxiety could be detected.

Keywords: underachievement; intelligence; emotions; motivation; self-regulated learning

1. Introduction

Underachievement is a widely discussed phenomenon in gifted education (Colangelo, 2003). Along with school-related factors (e.g. Colangelo, Assouline, & Gross, 2004; Kanevsky & Keighley, 2003; Reis, 2003) and family-related factors (e.g. Clark, 1983; Jeon & Feldhusen, 1993; Rimm & Lowe, 1988), various individual factors play an important role in underachievement (e.g. McCoach & Siegle, 2003; Snyder & Linnenbrink-Garcia, 2013). Among these individual factors, students' motivation, learning behavior, and emotions were examined as possible reasons for and characteristics of underachievement (cf. Reis & McCoach, 2000, for an overview). However, most studies focus only on one or two aspects (i.e. motivation, learning behavior, or emotions; e.g. Albaili, 2003; Kanevsky & Keighley, 2003; Laffoon, Jenkins-Friedman, & Tolleffson, 1989) and very few studies differentiate between different constructs within the investigated reasons (e.g. McCoach & Siegle, 2003).

To better understand the development of underachievement and in order to plan effective interventions, it is essential to know as much as possible about the reasons for underachievement and their interplay. Understanding the factors contributing to the underachievement of young students is particularly important, as this would allow educators to intervene while children are still relatively young. The first aim of our study was therefore to simultaneously examine various individual factors that might predict underachievement among gifted primary school students −motivation, learning behavior, and emotions −and to differentiate between various constructs among these individual factors. The second aim of our study was to examine the effectiveness of an intervention that focuses, either directly or indirectly, on the identified predictors of underachievement.

2. Aim 1: Identification of predictors of underachievement among gifted primary school students

2.1. Theoretical background

Motivation, learning behavior, and emotions as predictors of underachievement are often discussed in the research literature (cf. Reis & McCoach, 2000, for an overview). Yet, most studies only focus on predictors in isolation or do not differentiate enough between different constructs within these predictors. We first provide an overview of empirical studies examining individual differences between gifted achievers and underachievers as well as of predictors of underachievement among gifted students in order to highlight current research gaps.

2.1.1. Motivation among gifted underachievers

In many studies, lack of motivation is seen as a possible explanation for underachievement among gifted students (Rea, 2000). Such explanations fail to recognize, however, that motivation encompasses several constructs, each of which can have different effects on learning and performance depending on the given circumstances (cf. Schunk, Meece, & Pintrich, 2014). Here, focus will be put on constructs that we consider particularly important for the development of underachievement, namely self-concept, self-efficacy, and learning goal orientation.

Studies of underachievement among gifted students frequently refer to self-concept. Self-concept is the general perception of individuals about themselves in achievement situations (Shavelson & Bolus, 1982), relies strongly on social comparative information (Marsh, Walker, & Debus, 1991), and is rather stable over time (Shavelson, Hubner, & Stanton, 1976). Quantitative studies that examined differences in self-concept among gifted achievers and gifted underachievers have yielded mixed results. Van Boxtel and Mönks (1992) found lower levels of self-concept among gifted underachievers when comparing them to those of gifted achievers in secondary school. Similar results were found in studies by Figg, Rogers, McCormick, and Low (2012) and by Matthews and McBee (2007), who also studied secondary school students, and by Dedrick, Shaunessy-Dedrick, Suldo, and Ferron (2015), who examined college students. Kanoy, Johnson, and Kanoy (1980) also found lower self-concept levels among young gifted underachievers in fourth grade. In their longitudinal study, Sparfeldt, Schilling, and Rost (2006) also reported lower levels of self-concept among gifted underachievers in primary school when compared to their achieving peers, but these differences could no longer be detected in adolescence. McCoach and Siegle (2003) found that self-concept did not predict underachievement among secondary school students in a logistic regression analysis.

Closely related to the construct of self-concept is the construct of self-efficacy, which denotes an individual's judgment about being capable of successful performance in given academic tasks and of attaining designated goals (Bandura, 1977; Schunk, 1991). In the context of underachievement, self-efficacy has not been studied as extensively as self-concept. This is remarkable, as evidence from work done outside the field of giftedness research suggests that self-efficacy might be an even more important predictor of underachievement than self-concept for several reasons. Self-efficacy is task specific and correlates more strongly with achievement than self-concept (Bong & Skaalvik, 2003).

Despite the close conceptual link between self-efficacy and self-concept, the basis of reference for self-efficacy is the goals the individual wants to achieve, not comparisons to others. Furthermore, while self-efficacy is thought to be malleable (Bandura, 1977), self-concept is understood to be stable (Shavelson et al., 1976). Studies that report on the level of self-efficacy among gifted achievers and gifted underachievers are nevertheless rather rare. Previous case studies have found low levels of self-efficacy among gifted underachievers in secondary school (Diaz, 1998; Reis, Hébert, Diaz, Maxfield, & Ratley, 1995). In their quantitative study of differences between achieving and underachieving college students, Hsieh, Sullivan, and Guerra (2007) reported lower levels of self-efficacy among underachieving college students when compared to their higher achieving peers. The study did not provide information on students' intelligence, however. To the best of our knowledge, no studies report on differences in levels of self-efficacy between gifted achieving and underachieving primary school students.

Findings in giftedness research along with evidence from other areas led us to take a closer look at learning goal orientation as a predictor of underachievement. Students with a learning goal orientation work on increasing their competence, knowledge, and understanding through effortful learning (e.g. Dweck, 1986). Setbacks are considered to be part of the learning process. Learning goal orientation is self-referential, as students assess their development relative to their own previous performance instead of comparisons to other learners' performance (e.g. Ames, 1992; Ames & Archer, 1988; Dweck & Leggett, 1988; Elliot & Harackiewicz, 1996; Pintrich, 2000a). Research has shown that high levels of learning goal orientation lead to adaptive learning behavior, high confidence in ones' own abilities, and high performance (Pintrich, 2000b; Schunk et al. 2014). Therefore, it can be assumed that low levels of learning goal orientation might contribute to the development of underachievement. However, only few studies compare the learning goal orientations of gifted achievers and gifted underachievers. The existing studies indicate disadvantages in learning goal orientation among gifted underachievers. Hsieh et. al (2007) reported that high-achieving college students had higher levels of learning goal orientation than their underachieving peers; as already noted, the study did not provide intelligence scores. Payne, Rueda, and Dembo (2009) found significant differences in learning goal orientation between gifted achievers and gifted underachievers in secondary school with disadvantages for the latter group. In his discriminant analysis of goal orientations, Albaili (2003) found that learning goal orientation and competition differentiated gifted achievers and gifted underachievers in secondary school. Here as well, achievers had higher levels of learning

goal orientation and were more competitive than underachievers. To the best of our knowledge, no studies report on differences in learning goal orientation between gifted achievers and gifted underachievers in primary school.

In our study, we examine two of the three constructs described above as predictors of underachievement: self-efficacy and learning goal orientation. As indicated above, examining self-efficacy instead of self-concept has two main advantages: Self-efficacy is more task specific and more closely related to achievement than self-concept (Bong & Skaalvik, 2003); and self-efficacy is malleable (Bandura, 1977) and thus open to modification via intervention (Schunk & Ertmer, 2000). We include learning goal orientation as our second motivational construct on account of its positive relationship to adaptive learning behavior and performance.

2.1.2. Learning behavior of gifted underachievers

Maladaptive learning behavior is seen as another cause of underachievement among gifted students. Criteria for adaptive learning behavior comprise the use and quality of cognitive learning strategies, metacognitive learning strategies, and self-regulated learning (Zimmerman, 2000) Cognitive learning strategies comprise rehearsal strategies, elaboration strategies, and organization strategies (Weinstein, Husman, & Dierking, 2000). When rehearsal strategies are used, information is simply repeated without processing in a deeper sense; elaboration strategies build connections between prior knowledge and new information; and organization strategies are used to construct connections within the learning material. Lau and Chan (2001) found that underachievers applied fewer rehearsal strategies than achievers. It should be noted, however, that the study participants were not necessarily of high ability. Baker, Bridger, and Evans (1998) report a lack of organization strategies as predictors of underachievement among gifted students. Metacognitive learning strategies are used to control and regulate one's cognitive abilities (Flavell, 1979). They include, for example, self-assessment, goal setting, monitoring, and evaluation. Emerick (1992) found deficits in goal-setting competencies among gifted underachievers.

Self-regulated learning combines both cognitive and metacognitive learning strategies. It is an active and constructive process in which cognitive learning strategies and metacognitive learning strategies are essential (cf. Boekaerts, Pintrich, & Zeidner, 2000). In theoretical models of self-regulated learning, the cyclic nature of the process is stressed and the interplay between the different components examined (cf. Zimmerman, 2000). Baum, Renzulli, and Hébert (1995) found that gifted underachievers had poor skills in self-

regulation. McCoach and Siegle (2003) reported self-regulated learning as highly predictive of underachievement among gifted secondary school students. The lower students scored in self-regulation, the more likely they were underachievers. Similar results were found for university students (Baslanti & McCoach, 2006).

In primary school, many students are not yet able to optimally self-regulate their learning, even if they report using the necessary learning strategies (Stoeger, Steinbach, Obergriesser, & Matthes, 2014). As our study participants are very young, we decided to examine text-reduction strategies as an age-appropriate, basic cognitive learning strategy. Text-reduction strategies are already taught in primary school and are important whenever students have to work with texts in any subject. Therefore, it seems plausible that a lack of such strategies should contribute to underachievement in this age group.

2.1.3. Academic emotions of underachieving gifted students

Academic emotions, which are emotions experienced in learning and achievement situations, are currently receiving increasing amounts of attention in educational research (Pekrun & Linnenbrink-Garcia, 2014). The emotions of enjoyment, anxiety, anger, and boredom are frequently studied and highly prevalent in classroom settings (e.g. Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007; Pekrun, Goetz, Titz, & Perry, 2002). Research among average students has shown that the negative emotions of anxiety, anger, and boredom correlate negatively with intrinsic motivation, effort, learning behavior, and performance, while the positive emotion of enjoyment positively correlates with these aspects (Ainley & Hidi, 2014; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). Furthermore, evidence from path analyses shows that students' emotions influence their self-regulated learning and their motivation, and that these, in turn, affect academic achievement (Mega, Ronconi, & De Beni, 2014). Therefore, a relationship between emotions and underachievement can be assumed. However, in research on underachievement of gifted students, only the emotions of anxiety and boredom have been examined, albeit not yet thoroughly. Other academic emotions were not taken into account, although they, too, might be predictive of underachievement.

Anxiety is an unpleasant emotion that has a negative impact on performance (Eysenck, Derakshan, Santos, & Calvo, 2007; Zeidner, 1998). Accordingly, in their lists of characteristics of underachievers, several authors come up with a profile they term the "anxious underachiever" (Heacox, 1991; Mandel & Marcus, 1988; Mandel & Marcus, 1996; Rimm, 1995). Some research findings support this assumption. Van Boxtel and Mönks

(1992), for example, found higher levels of test anxiety among gifted underachievers than among gifted achievers in secondary school. However, Vlahovic-Stetic, Vidovic, and Arambasic (1999) did not find differences in mathematical anxiety between gifted achievers and gifted underachievers in primary school. Taking a more differentiated look, Preckel, Holling, and Vock (2006) measured two different forms of anxiety: fear of failure and facilitating anxiety, which is a positive form of anxiety. Fear of failure was a positive predictor of underachievement, while facilitating anxiety was a negative predictor of underachievement. The higher the level of fear of failure and the lower the level of facilitating anxiety among gifted students, the more likely they were to qualify as underachievers.

For boredom, a distinction can be made between boredom due to under- and over-challenging situations (e.g. Acee et al., 2010). Research on underachievement among gifted students focused especially on the first form of boredom. Curricula that fail to provide gifted pupils with sufficient amounts of challenge are regarded as one of the causes of underachievement among gifted students (Heacox, 1991). This is corroborated in the case studies described by Reis et al. (1995) that also implicate an unchallenging curriculum as a source for boredom among gifted underachievers in high school. Furthermore, Kanevsky and Keighley (2003) report from their case study that one reason for underachievement among gifted students in high school is a lack of challenge that resulted in boredom.

2.1.4. Current study

The first aim of this study is to examine which individual factors contribute to the underachievement of gifted students at an early point in their academic career, as a better understanding of these factors will help educators to intervene effectively as early as possible. To do this, we simultaneously consider different aspects of motivation, learning behavior, and achievement emotion. To date, very few studies simultaneously include different individual factors, McCoach and Siegle (2003) being a notable exception. They do not, however, include emotional factors that might predict underachievement. Furthermore, in research on underachievement among gifted students, only the emotions of anxiety and boredom have been examined. Information on other emotions is lacking. Therefore, we want to simultaneously examine factors pertaining to motivation, learning behavior, and emotions for which existing research suggests they will be of particular importance for understanding early school-career underachievement. We chose self-efficacy and learning-goal orientation as motivational aspects because they show close relations to performance and other variables

that influence performance. Concerning learning behavior, we included cognitive text-reduction strategies because they are important for all learning processes that involve gathering information from texts and because they can already be acquired in primary school. We decided not only to include the emotions of anxiety and boredom, but also anger and enjoyment becauseinformation about emotions among gifted underachievers is too scarce for justifying a tighter selection.

2.2. Method

2.2.1. Participants and design

The sample for this investigation consisted of a subset of $N = 85$ highly intelligent students from a lager sample of more than 2400 fourth graders attending primary schools in Germany. Students' mean age was 10.26 years ($SD = .36$) and 63.5% of them were girls; none of them had a migration background (i.e. neither the pupils nor either of their parents was born outside of Germany). All students had scored the 90th percentile in an IQ test. Twenty-four of the students were identified as underachievers, as their z-standardized grade point average (GPA) in the main subjects was at least one standard deviation below their z-standardized IQ score. Thirteen underachievers were girls; eleven of them were boys. Students completed an in-class questionnaire on their motivation, learning behavior, and emotions. Their teachers read standardized questionnaire instructions to the students and answered all procedural questions, thus ensuring that everyone, including weak readers, could complete the questionnaire as intended. Participation in the study was voluntary and parents gave their consent.

2.2.2. Measures

Cognitive ability

To measure students' general intelligence, the German version of Raven's Standard Progressive Matrices Test (Heller, Kratzmeier, & Lengfelder, 1998) was used. The non-verbal multiple-choice test consists of 60 tasks in which students are asked to select the object from among six or eight objects that completes a given pattern.

Scholastic achievement

Students' GPA on their last report card for the subjects of mathematics, German (native language), and basic science[1] served as a measure of scholastic achievement. These grades were provided by the students' teachers. In Germany, the best grade possible is 1 and the poorest grade is 6. For easier interpretation, we scaled grades in the analysis inversely, with 6 indicating the highest possible level of scholastic achievement.

Self-efficacy

As a measure of students' self-efficacy, a seven-item scale by Schwarzer and Jerusalem (1999) was adapted and reduced to six items. Students were asked to report their self-efficacy when working with texts (sample item: I can understand even difficult texts in class when I make an effort). The answers were assessed on a six-point Likert scale ranging from 1 (*completely disagree*) to 6 (*completely agree*). As loading for one of the six items was relatively low, the scale was reduced to 5 items for further calculations. Cronbach's alpha was then .71.

Learning goal orientation

Students' learning goal orientation was measured with a six-item scale based on the Manual for the Patterns of Adaptive Learning Scales by Midgley et al. (1998) (sample item: In school, I want to learn as much as possible). Answers ranged from 1 (*completely disagree*) to 6 (*completely agree*). Cronbach's alpha was .72.

Cognitive text-reduction strategies

Students' use of cognitive text-reduction strategies was measured with four items asking whether students used the text-reduction strategies of underlining, note-taking, drawing mind maps, or writing summaries (sample item: When I read a text, I underline its main ideas). Answers were assessed on a six-point Likert scale ranging from 1 (*completely disagree*) to 6 (*completely agree*), with Cronbach's alpha at .72.

Academic emotions

To assess the academic emotions of anxiety, boredom, anger, and enjoyment when working with texts, emotion measures were adapted from the Achievement Emotions Questionnaire ([AEQ], Pekrun et al., 2011). Following the distinction between trait and state

[1] The subject is called *Heimat- und Sachunterricht* in Bavaria, Germany, and deals with basic aspects of everyday life, including topics from biology, geography, physics, health, and social sciences.

emotions (Cattell & Scheier, 1961; Spielberger, 1972), four trait-oriented, dispositional emotions were evaluated: anxiety (sample item: I feel tense and nervous when working with texts.), boredom (sample item: Just thinking about working with texts makes me feel bored.), anger (sample item: I am angry when working with texts.), and enjoyment (sample item: I enjoy working with texts.). Each emotion was measured with a six-point Likert scale ranging from 1 (*completely disagree*) to 6 (*completely agree*). Cronbach's alpha was .81 for anxiety, .84 for boredom, .82 for anger, and .84 for enjoyment.

2.3. Results

Table 1 presents means and standard deviations for all the measures administered to achievers and underachievers as well as t-statistics and Cohen's *d* effect sizes of group differences. Underachievers scored significantly lower than achievers in scholastic achievement and self-efficacy and reported higher use of text-reduction learning strategies and higher levels of anxiety. No differences were found with regard to the other variables. Correlations of all predictor variables are presented in Table 2. All of them were sufficiently low to exclude multicollinearity.

Table 1

Means, standard deviations, and t-tests of predictor variables.

	Gifted achievers		*Gifted underachievers*			
Variable	*M*	*SD*	*M*	*SD*	*t*	*d*
Cognitive ability	50.72	1.69	50.54	1.47	0.46	0.11
Scholastic achievement	5.27	.43	4.28	.54	08.96*	2.05
Self-efficacy	5.02	.56	4.35	0.58	4.93*	1.18
Learning goal orientation	4.97	0.71	4.75	0.85	1.22	0.28
Text-reduction strategies	2.25	0.87	2.94	1.12	−3.04*	0.69
Anxiety	1.78	0.81	2.67	1.19	−3.38*	0.88
Boredom	2.20	1.08	2.53	1.14	−1.25	0.30
Anger	2.13	0.98	2.62	1.15	−1.99	0.46
Enjoyment	3.83	1.13	3.13	1.15	−2.59	0.62

Note: $n = 85$. For each t-test, $df = 83$.
The Bonferroni method of adjustment was used to control for Type I error among predictor variables; t-values were considered significant at $p < .05$ if the observed $p < .007$.
*$p < .05$.

Table 2
Correlations of predictors.

Variable	1	2	3	4	5	6
1. Self-efficacy	–					
2. Learning goal orientation	.422**	–				
3. Text-reduction strategies	.014	.222*	–			
4. Anxiety	−.298**	−.162	.251*	–		
5. Boredom	−.361**	−.238*	−.152	.225*	–	
6. Anger	−.420**	−.209	−.083	.519**	.722**	–
7. Enjoyment	.486**	.292**	.100	−.536**	-.654**	−.760**

Note. $^{*}p < .05$ $^{**}p < .01$

A binary logistic regression was performed in order to investigate which set of factors among self-efficacy, learning goal orientation, cognitive learning strategies, anxiety, boredom, anger, and enjoyment best predicts a students' group membership as either a gifted achiever or a gifted underachiever. A test of the full model with all the predictors included against a null model with no predictor variables was statistically significant ($\chi^2(7) = 39.461$, $p < .001$). Regression coefficients and changes in odds are presented in Table 3.

Table 3
Logistic regression results.

	Full model with all predictors included				*Final model*			
Variable	*B*	SE	Wald	OR	*B*	SE	Wald	OR
Self-efficacy	−2.613*	.781	11.189	.073	−2.501*	.676	13.673	.082
Learning goal orientation	.086	.424	.041	1.090				
Text-reduction strategies	.879*	.381	5.318	2.408	.915*	.353	6.727	2.498
Anxiety	.866*	.416	4.329	2.377	.758*	.331	5.247	2.134
Boredom	.075	.448	.028	1.078				
Anger	−.397	.510	.607	.672				
Enjoyment	−.165	.486	.115	.848				

Note: OR = Odds Ratio.
$^{*}p < .05$.

The odds ratio is an indicator for the change in odds that results from a one-unit change in the predictor (see Hosmer, Lemeshow, & Sturdivant, 2013). Nevertheless, looking at the individual predictor variables shows that only students' self-efficacy, use of text-reduction strategies, and anxiety were statistically significant predictors of underachievement. Neither learning goal orientation, the second motivational variable we

included in our analysis, nor the other emotional variables of boredom, anger, or enjoyment predicted students' achievement status significantly. Therefore, we conducted a series of logistic regression models, each with one of the non-significant predictors removed (Tabachnick & Fidell, 2014). None of the previously non-significant predictors became significant in any of these models. The final model included only the significant predictors, namely, self-efficacy, cognitive text-strategy usage, and anxiety (Table 3). It was again significantly better than the null model ($\chi^2(3) = 38.706$, $p < .001$). Students' self-efficacy was negatively associated with being an underachiever. For each one-unit increase in self-efficacy, the odds of being an underachiever decreased by .08. With increasing academic anxiety, on the other hand, the odds of underachievement increased by 2.13. Surprisingly, students' use of text-reduction strategies was also positively associated with underachievement. For each one-unit increase in the use of text-reduction strategies, the odds of underachievement increased by 2.50.

Nagelkerke's R^2 is reported as a pseudo R^2 statistic that approximates variance interpretation for R^2 in multiple linear regression analyses (Tabachnick & Fidell, 2014). For the final model, the Nagelkerke pseudo R^2 was .53. The percentage of overall accuracy of classification was 77.6%. Of the underachievers, 70.8% were correctly identified as such (i.e. sensitivity), while 80.3% of the achievers were correctly identified (i.e. specificity).

2.4. Discussion

Our first aim was to simultaneously examine different individual factors that might predict underachievement among gifted students at the end of primary school, namely, motivation, learning behavior, and emotions. We included self-efficacy and learning goal orientation as motivational constructs, use of text-reduction strategies as representative of learning behavior, and anxiety, boredom, anger, and enjoyment as achievement emotions. Logistic regression analysis revealed self-efficacy, use of cognitive text-reduction strategies, and anxiety as predictors of underachievement. The less self-efficacy and the more anxiety students reported, the more likely they were underachievers. These results were consistent with our expectations. Contrary to our expectations and contrary to research findings (e.g. Pintrich & de Groot, 1990; Robbins et al., 2004), use of cognitive learning strategies turned out to be a positive predictor of underachievement. The more students reported using text-reduction strategies, the more likely they were underachievers. One possible explanation for this counterintuitive finding is that frequent application of learning strategies does not necessarily mean that they are applied correctly (Artelt, 2000). To explore this assumption,

we calculated correlations between students' self-reports about the use of text-reduction strategies, and their achievement in a text comprehension test. The overall correlation between the use of text-reduction strategies and achievement in our study was significantly negative ($r = -.24$, $n = 84$, $p = .03$), again indicating that the more cognitive text-reduction strategies students used, the lower was their achievement. However, results were different when the groups of achievers and underachievers were considered separately. For the group of achievers, the correlation was positive and marginally significant ($r = .24$, $n = 61$, $p = .06$) and thus offered some initial support for the assumption that applying cognitive strategies more frequently may correlate with higher achievement. However, for the group of underachievers, the correlation was negative ($r = -.51$, $n = 23$, $p = .01$), meaning that the more frequently underachievers reported using text-reduction strategies, the lower their scores in the standardized text comprehension test were. These results lead us to the assumption that although underachievers might frequently use text-reduction strategies, they might not know how to apply them correctly. For this reason, underachieving gifted students appear to need training in the correct use of learning strategies, especially as some interventions in this field also seem to indirectly −but positively−influence the other two predictors of underachievement found in our study, namely, self-efficacy and anxiety.

3. Aim 2: Evaluating the effects of a self-regulated learning intervention on predictors of underachievement

3.1. Theoretical background

Research on intervention programs with gifted underachievers remains scarce and the results are mixed (McCoach & Siegle, 2011). When an intervention is designed, it is important that it is simultaneously addresses as many predictors of underachievement as possible. Interventions on self-regulated learning positively influence various aspects that predict underachievement already in primary school. Among these are learning behavior (e.g. Fuchs et al., 2003; Souvignier & Mokhlesgerami, 2006), motivation (Guthrie et al., 2004; Mason, 2004), and academic emotions (e.g. Obergriesser, Steinbach, & Stoeger, 2013).

Given these results, we chose to implement an intervention on self-regulated learning with our sample of gifted underachievers and achievers within their regular classrooms. We chose the program by Stoeger and Ziegler (2008b) that enhances various metacognitive learning strategies such as self-assessment and monitoring in combination with cognitive learning strategies, which should make the intervention particularly effective for primary

school students (Dignath & Büttner, 2008). During the intervention, students' use of text-reduction strategies− one of our predictors of underachievement − is systematically trained, monitored, and improved over several weeks. The intervention, which can be implemented during regular classroom instruction, has already been positively evaluated with average students (Stoeger, Sontag, & Ziegler, 2014), and was proven suitable for highly intelligent and high-achieving students (Sontag & Stoeger, 2015). There is also evidence that the intervention concept might positively influence self-efficacy (Stoeger & Ziegler, 2008a) and emotions (Obergriesser et al., 2013). The second aim of our study was to evaluate the effectiveness of this intervention with the gifted underachievers in our sample and to test whether it is suitable for positively influencing learning behavior, self-efficacy, and anxiety.

3.2. Intervention

The intervention program lasts seven weeks and is implemented on a daily basis during regular classroom instruction and homework. It is divided into two distinct parts, with two informational weeks being followed by five so-called learning cycle weeks. During the information weeks, students accumulate declarative knowledge about cognitive text-reduction strategies and metacognitive learning strategies that are important for self-regulated learning. These include strategies such as self-assessment, goal setting, and monitoring. Then, during the learning cycle weeks, students get the chance to proceduralize this knowledge while working with basic science texts in class and during homework.

Approximately 40 − 60 minutes of instruction time per day are spent on the intervention program. During the first information week, teachers present and model three different text-reduction strategies that are useful for identifying and displaying the main ideas of a text: (a) underlining and copying main ideas verbatim, (b) drawing a mind map containing the main ideas, and (c) summarizing main ideas in one's own words. During the second information week, students learn about metacognitive learning strategies that are important for self-regulated learning such as self-assessment, goal setting, and monitoring one's own learning behavior. During the learning cycle weeks, students repeatedly and mindfully work through all steps of a learning cycle that includes the cognitive and metacognitive learning strategies mentioned above (for more information, cf. Ziegler & Stoeger, 2005). Every day, students are asked to identify the main ideas in an expository text with the help of the strategies they got to know during the information weeks. The number of correctly identified main ideas serves as an indicator with which students evaluate their competence in the application of text-reduction strategies. All the texts contain the same

number of main ideas and are of comparable length and difficulty to make it easier for students to draw connections between performance and learning behavior. To do this, students keep a learning journal in which they systematically document their learning behavior and their performance. For example, they write down their number of correctly identified main ideas on a daily basis. To enhance self-assessment, students are asked to write down −every day and prior to their work on the day's text −how many main ideas they think they will be able to find. After task control, comparisons are then made between self-assessments and the number of main ideas that the students actually identified correctly. Students develop strategy monitoring by monitoring their strategy implementation and writing down whether they have monitored their learning strategies during their work on thetexts. Classroom discussions and teacher feedback support these processes and make connections apparent between learning behavior and outcomes in order to illustrate to students that learning strategies are helpful and support the learning process (cf. Stoeger & Ziegler, 2008b; and Stoeger et al., 2014, for further information).

3.3. Method

3.3.1. Participants and design

The intervention, which was not a pull-out program, was carried out in regular classrooms with students of different ability levels. Thirty-four classes participated in the study. In these classes, $N = 85$ students were highly intelligent (cf. the first part of this study); of these, $n = 24$ students were identified as gifted underachievers and $n = 61$ were gifted achievers. Eighteen classes were assigned to the intervention group and sixteen classes served as a comparison group that received regular instruction. This resulted in $n = 14$ underachievers and $n = 38$ achievers in the intervention group as well as $n = 10$ underachievers and $n = 23$ achievers in the control group.

At T1, a questionnaire was used to identify underachievers (cf. the Method section of Aim 1). Subsequently, the intervention was carried out over a period of seven weeks. After the training was completed, at T2, a questionnaire was again used to measure the effects of the intervention on the predictors of underachievement identified at T1 for both groups. Students answered the questionnaires in class. Their teachers read standardized questionnaire instructions to the students and answered all procedural questions, thus ensuring that everyone, including weak readers, could complete the questionnaire as intended. Participation in the study was voluntary and parents had expressed consent. For

the intervention group we also gathered process data from the learning journals and intervention tasks implemented during the five learning-cycle weeks.

3.3.2. Measures

Questionnaire

Detailed information on the questionnaire is provided in the Method section of Aim 1. Scales used at T2 were use of text-reduction strategies, self-efficacy, and anxiety.

Expository texts and learning journal

Competence in identifying main ideas. During the learning cycle weeks, students were asked every school day to find the ten main ideas in an expository science text. All of the texts were of the same length (about 420 words) and difficulty. To reduce daily fluctuation in the number of correctly identified main ideas, we calculated the weekly average as a measure of competence in identifying main ideas for five weeks.

Errors in self-assessment. The quality of self-assessment was measured as the absolute discrepancy between students' self-assessment concerning the number of main ideas they thought themselves capable of correctly identifying in a given text and the number they actually identified. The possible score ranged from 10 to zero, with small values indicating good self-assessment, as they indicate that students made few errors in their self-assessment. Here, too, the weekly average was calculated for the five weeks in order to reduce daily fluctuations.

Strategy monitoring. Students reported their strategy monitoring directly after they worked on the text with a single-item six-point Likert scale (item: I monitored myself while I was applying my strategies) ranging from 1 (*completely disagree*) to 6 (*completely agree*). The weekly average was entered in subsequent calculations.

Anxiety. In addition to the trait emotion of anxiety, which is measured by the questionnaire, state emotions were included in the learning journal. Here, students' anxiety is measured directly in the learning situation prior to working on the text with a single-item scale (item: Prior to working on the text I am scared.) ranging from 1 (*completely disagree*) to 6 (*completely agree*). As for the measures in the learning journal described above, the weekly average of state anxiety was entered in subsequent calculations.

3.3.3. Plan of analysis

In order to evaluate the impact of the intervention program on students' use of cognitive text-reduction strategies, a 2 x 2 (time x treatment condition) repeated-measurements ANOVA was performed comparing students' use of cognitive text-reduction strategies in the intervention group from pre-test and post-test to the results of the control group. Furthermore, to test for differential training effects among underachievers and achievers, we conducted a 2 x 2 x 2 (time x treatment condition x achievement group) repeated-measurements ANOVA. Yet, as indicated above, the extent to which students use text-reduction strategies does not necessarily indicate that they apply these strategies correctly. For this reason, we also looked at three aspects of learning behavior with the help of two-level models of longitudinal change (Singer & Willett, 2003). We estimated students' development of their competence in identifying main ideas and also analyzed the development of two metacognitive strategies, namely, self-assessment and strategy monitoring. The development of self-assessment was assessed via errors in self-assessment; therefore, a decrease indicates an improvement of self-assessment.

In two-level models of longitudinal change, the level-1 model describes each student's change trajectory with growth-curve parameters and the level-2 model describes individual differences in these growth-curve parameters. To partition the within-student variability and between-student variability in competence in identifying main ideas, self-assessment, and strategy monitoring, we estimated three unconditional means models (without predictors). To examine the general trend of the development of the academic emotions, three unconditional growth models were estimated (with only time as a predictor). These initial models provide information to assess whether there was systematic mean-level change and individual variability in learning behavior. In the next step, underachievement was introduced as a predictor for mean levels and change. Underachievement was dummy-coded with "1" indicating that the student was identified as an underachiever and "0" indicating that this was not the case. Continuous variables were not centered. Model fit was assessed by implementing deviance-based hypothesis tests (cf. Singer & Willet, 2003). All multilevel models were fit using the HLM 6.08 software and full maximum likelihood estimation.

The equations for the multilevel growth models used in this study are as follows:
For the unconditional models:

Level 1: $Y_{ij} = \pi_{0i} + \pi_{1j}(time)_{ij} + \varepsilon_{ij}$

Level 2: $\pi_{0j} = \gamma_{00} + \zeta_{0j}$

$\pi_{1j} = \gamma_{10} + \zeta_{1j}$

where Y_{ij} represents the focal outcome variable (e.g. strategy monitoring), γ_{00} and γ_{10} are, respectively, average initial status and average rate of change. Residual variance is represented with ζ_{0j}, ζ_{1j}, and ε_{ij} representing, respectively, residual variance in initial status, residual variance in rate of change, and within-person residual variance.
For the conditional models:

Level 1: $Y_{ij} = \pi_{0i} + \pi_{1j}(time)_{ij} + \varepsilon_{ij}$

Level 2: $\pi_{0j} = \gamma_{00} + \gamma_{01}(underachiever) + \zeta_{0j}$

$\pi_{1j} = \gamma_{10} + \gamma_{11}(underachiever) + \zeta_{1j}$

The intervention's impact on students' self-efficacy and anxiety, our other predictors of underachievement, was measured as well. Both aspects were examined at pre- and post-test with a 2 x 2 ANOVA in the same way it was done on students' use of cognitive text-reduction strategies. Additionally, students' anxiety was measured directly in the learning situation prior to working on the texts. Here, as well, growth curves were fitted as described for learning behavior.

3.4. Results

The means, standard deviations, and effect sizes of cognitive text-reduction strategies, self-efficacy, and anxiety at pre- and post-test of gifted underachievers and their achieving peers are presented in Table 4.

The 2 x 2 repeated-measurements ANOVA conducted to compare students' use of cognitive text-reduction strategies at pre- and post-test between the self-regulated learning group and the regular instruction group showed a significant interaction effect for time and treatment condition ($F(1, 83) = 20.60$, $p < .001$, partial $\eta^2 = .20$). Use of cognitive text-reduction strategies in the intervention condition increased ($t = -7.23$, $df = 51$, $p < .001$), while it remained stable for the group with regular classroom instruction ($t = -0.23$, $df = 32$, $p > .05$). No differential intervention effects ($F(1, 81) = 0.09$, $p > .05$, partial $\eta^2 = .001$) for the use of cognitive text-reduction strategies were found when comparing underachievers to achievers in a 2 x 2 x 2 (time x treatment condition x achievement group) repeated-

measurements ANOVA. Effect sizes for changes in text-reduction strategies in the respective groups are reported in Table 4.

Learning behavior was also measured during the learning cycle weeks with the help of a learning journal. Descriptive statistics of weekly average scores of the three aspects of learning behavior that we measured (competence in identifying main ideas, self-assessment, and strategy monitoring) are presented in Table 5. As described in the plan of analysis, growth curves were modeled to examine students' learning behavior over the course of the intervention.

Results of the different growth-curve models are presented in Table 6. Unconditional mean models (Model 0) allow calculating the intraclass correlation coefficient that shows that 40% of variance in competence in identifying main ideas (57% for self-assessment and 37% for strategy monitoring) is attributable to within-person components. Model 1 presents the results of the unconditional growth models for each variable. For all outcome variables of learning behavior, adding a linear slope to the model significantly improved the model. Table 6 shows that students increased in competence in identifying main ideas over the five learning cycle weeks and that errors in self-assessment decreased significantly during that time. The growth rate for strategy monitoring is not significant. Nevertheless, the variance in the growth rate is significant, suggesting that there are individual differences in the rate of growth. For competence in identifying main ideas and also for errors in self-assessment, variance in the growth rate is not significant, indicating that there is no more variance left to be explained by variables other than time. Model 2 presents the results of the conditional model when underachievement is added as a predictor for each outcome variable.

Table 4

Descriptive statistics and effect sizes for pre-test and post-test in intervention (SRL) and regular instruction (REG) group.

				Pre-test				Post-test				Post-test effect size adjusted for pre-test effect size [a, b]
		SRL	REG	SRL		REG		SRL		REG		
Dependent variable	Subgroup	*n*	*n*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	
Text-reduct. strategies	Underachievers	14	10	3.07	1.05	2.75	1.24	3.93	0.85	2.60	1.04	0.31
	Achievers	38	23	2.22	0.86	2.29	0.91	3.20	0.98	2.40	0.93	0.18
	All students	52	33	2.45	0.98	2.43	1.02	3.39	1.00	2.46	0.96	0.16
Self-efficacy	Underachievers	14	10	4.45	0.52	4.13	0.59	4.67	0.71	3.97	0.57	0.12
	Achievers	38	23	4.96	0.54	4.86	0.53	4.89	0.62	4.89	0.65	−0.02
	All students	52	33	4.82	0.58	4.64	0.63	4.83	0.65	4.61	0.75	0.01
Anxiety	Underachievers	14	10	2.41	1.09	3.03	1.28	1.81	0.62	2.50	1.00	−0.03
	Achievers	38	23	1.72	0.77	1.88	0.88	1.59	0.83	1.84	0.89	−0.02
	All students	52	33	1.91	0.91	2.23	1.13	1.65	0.78	2.04	0.96	−0.01

[a]Effect size was computed as $d = (M_A\text{-}M_B)/SD_{AB}$ with $SD_{AB} = \sqrt{[(n_A\text{-}1)*SD_A^2 + (n_B\text{-}1)*SD_B^2]/[((n_A\text{-}1) + (n_B\text{-}1)]}$ (cf. Bortz & Döring, 2006, pp. 606–607, for comparing samples of different sizes).

[b] Positive values for effect sizes indicate a higher level in the intervention group. Adjusted effect size was calculated as post-test effect size minus pre-test effect size.

Table 5

Descriptive statistics of weekly average scores of learning behavior during the learning cycle weeks.

	LC Week 1		LC Week 2		LC Week 3		LC Week 4		LC Week 5	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Main ideas	7.41	1.13	7.24	1.28	7.81	1.43	7.81	1.28	7.91	1.00
Self-assessment	1.87	1.13	1.45	0.84	1.76	0.91	1.26	0.70	1.20	0.76
Strategy-monitoring	4.37	0.97	4.47	0.97	4.56	0.78	4.50	1.04	4.36	1.27
Anxiety	1.64	1.08	1.62	1.13	1.72	1.31	1.53	1.11	1.48	1.10

Note: Main ideas = Competence in identifying main ideas; LC Week = Learning cycle week

For competence in identifying main ideas, results show that underachievement negatively influences initial status. This indicates that underachievers had a lower level of competence at the beginning of the learning cycle weeks than achievers. As variance in the growth rate in Model 1 had already been non-significant, differences in growth rates between underachievers and achievers could not be detected. The initial status of errors in self-assessment is not influenced by underachievement; differences in growth rates again could not be detected, given the non-significant variance in the growth rate already in Model 1. However, there is an effect of underachievement on strategy monitoring. Underachievement does not influence the intercept in the initial status of strategy monitoring, which means that at the beginning of the intervention program, underachievers and achievers seem to monitor their learning strategies at about the same (high) levels. However, the slope is influenced by underachievement. Underachievers increase their strategy monitoring during the intervention, while the strategy monitoring of achievers remains stable over the five weeks.

As described in the Measures section, the intervention's impact on self-efficacy and anxiety was evaluated in a manner similar to the pre–post-test comparisons conducted for cognitive text-reduction strategies. For self-efficacy, the 2 x 2 ANOVA effects were not significant (F (1, 83) = 0.09, $p > .05$, partial $\eta^2 = .00$) indicating no intervention effects on self-efficacy for the overall group of students. The 2 x 2 x 2 ANOVA on differential effects came to a marginally significant result (F(1, 81) = 2.92, $p < .1$, partial $\eta^2 = .04$). Paired-sample t-tests were not significant; however, means indicate tendencies of improvement in self-efficacy among underachievers. Concerning anxiety, no significant results were detected, neither in the 2x2 ANOVA nor in the 2x2x2 ANOVA (with F(1, 83) = 0.15, $p > .05$, partial $\eta^2 = .00$, and F (1, 81) = 0.00, p > .05., partial $\eta^2 = .00$, respectively). Furthermore, students' anxiety over the course of the intervention was examined with growth-curve models. To do this, we used the weekly average of the anxiety level that the students reported prior to working on the daily texts as entered in their learning journals. Here, 32% of variance

is attributable to within-person components. Deviance statistics showed a better fit of the unconditional linear growth model over the unconditional means model (with a deviance of 511.34 as compared to 562. 77 in the unconditional means model). This was also corroborated by a model-comparison test ($\chi^2(3) = 51.42830$, $p < .001$). Yet, with an intercept of $\gamma_{00} = 1.698$, $t(51) = 8.926$, $p < .05$ for initial status, the intercept for rate of change did not reach significance ($\gamma_{10} = -0.028$, $t(51) = -0.577$, $p > .05$). There remained, however, significant variance in initial status ($\zeta_{0j} = 1.513$, $\chi^2(51) = 390.240$, $p < .001$) and rate of change ($\zeta_{1j} = 0.098$, $\chi^2(51) = 252.220$, $p < .001$), indicating that other variables could account for variance in anxiety. Adding underachievement to the model, however, did not improve the model ($\chi^2(2) = 3.14377$, $p > .05$). Underachievement therefore did not account for variance in students' anxiety prior to working on the intervention texts.

Table 6

Trend of changes in learning behavior over the learning cycle weeks.

		Main ideas			Errors in self-assessment			Strategy monitoring		
		Model 0	Model 1	Model 2	Model 0	Model 1	Model 2	Model 0	Model 1	Model 2
Fixed effects										
Initial status	Intercept	7.628*	7.165*	7.407*	1.545*	1.973*	1.824*	4.438*	4.439*	4.470*
		(0.143)	(0.168)	(0.163)	(0.099)	(0.162)	(0.150)	(0.122)	(0.140)	(0.177)
	Underachievement			─0.898*			0.567			─0.129
				(0.425)			(0.455)			(0.251)
Rate of change	Intercept		0.155*	0.126*		─0.145*	─0.121*		─0.001	─0.038
			(0.032)	(0.033)		(0.036)	(0.035)		(0.036)	(0.045)
	Underachievement			0.108			─0.092			0.147*
				(0.082)			(0.102)			(0.056)
Random effects										
Level 1	Within-student	0.624*	0.562*	0.556*	0.521*	0.425*	0.425*	0.395*	0.308*	0.307*
		(0.062)	(0.064)	(0.064)	(0.052)	0.050	(0.050)	(0.040)	(0.036)	(0.036)
Level 2	In initial status	0.931*	0.883*	0.750*	0.397*	0.875*	0.814*	0.677*	0.655*	0.654*
		(0.965)	(0.940)	(0.866)	(0.630)	(0.936)	(0.902)	(0.823)	(0.809)	(0.809)
	In rate of change		0.001	0.001		0.024	0.022		0.034*	0.030*
			(0.023)	(0.029)		(0.155)	0.149		(0.185)	(0.174)
	Covariance		0.009	0.020		─0.119*	─0.109*		─0.043	─0.040
			(0.050)	(0.048)		(0.057)	0.055		(0.042)	(0.041)
Deviance		715.907	694.976	689.164	626.124	600.525	598.008	583.400	568.216	564.461

Note: Main ideas = Competence in identification of main ideas.
Values in parenthesis are the standard errors, except for variance in initial status and in rate of change, for which the HLM software reports the standard deviations.
*$p < .05$.

4. General discussion

The first aim of this study was to examine which individual factors contribute to the underachievement of gifted students at an early point in their academic career, as this would allow educators to intervene as early as possible. Aspects from motivation, learning behavior, and emotions were identified as predictors of underachievement, namely, self-efficacy, use of text-reduction strategies, and anxiety.

The second aim of the study was to test whether an intervention program that enhances self-regulated learning is effective for improving these predictors. Prior research has shown that interventions on self-regulated learning can positively influence learning behavior and motivation (cf. Dignath & Büttner, 2008) and may influence students' emotions (Obergriesser et al., 2013). An intervention program by Stoeger and Ziegler (2008b) was chosen for two reasons: First, it helps students develop their use of text-reduction strategies within a framework of self-regulated learning. Second, it was positively evaluated for students of different ability levels (Sontag & Stoeger, 2015; Stoeger et al., 2014). Based on the evaluation results, we expected positive effects on learning behavior. Although there are hints in research literature that the interventions such as the one chosen here might also positively influence self-efficacy (Schunk & Ertmer, 2000) and anxiety (Pekrun et al., 2002), we expected a weaker effect on these variables as they were not directly targeted in the intervention.

As expected, positive effects of the intervention program could be detected for learning behavior among gifted underachievers and also among gifted achievers. Both achievement groups seemed to profit from the intervention program, showing increases in the use of text-reduction strategies, in competence in identifying main ideas, and in self-assessment. However, only underachievers increased in strategy monitoring over time. The underachievers who had reported using text-reduction strategies more often compared to achievers prior to the intervention seemed to realize that it is necessary not only to apply learning strategies, but to also apply them correctly and that monitoring could help them to do so.

Although the effect sizes were rather small, they show that the intervention was successful. Results from a meta-analysis by Dignath, Buettner, and Langfeldt (2008) indicate that interventions on self-regulated learning in the domain of reading and writing instruction generally had moderate effects (mean effect size: 0.55). Furthermore, interventions that are implemented by the teachers had considerably lower effect sizes (mean effect size: 0.57)

than interventions implemented by researchers (mean effect size 0.84), irrespective of the domain of instruction. For our study, it should be kept in mind that the intervention was implemented in the regular classroom context of reading and writing instruction by the regular teachers. In contrast to other interventions on underachievement, students were not placed in special classes (e.g. Supplee, 1990), and the intervention did not focus on a small number of students (e.g. Baum et al. 1995; Rubenstein, Siegle, Reis, McCoach, & Burton, 2012); all students in each classroom participated. Therefore, teachers made sure that all students, of all cognitive abilities, could follow the intervention. Teachers were not informed about which students in their classes were gifted underachievers; and because many underachievers still performed at rather high levels, teachers might not have paid special attention to them but rather to the students who were obviously struggling. It can be assumed that effects on the underachieving students might be considerably higher when underachievers receive special attention or are taught in particular groups.

With regard to the motivational construct of self-efficacy that predicted underachievement, only tendencies of improvement were visible. The intervention was not designed to foster self-efficacy, however, but to enhance adaptive learning behavior. Given the close relationship between self-efficacy and performance (Fast et al., 2010), an increase in self-efficacy might occur in the long run when students experience how adaptive learning behavior leads to better achievement.

Neither the analysis of the questionnaire data nor of the learning journals showed intervention effects for anxiety, the third predictor of underachievement. This result is not unexpected as the level of anxiety among students was already quite low in the group of gifted students prior to the intervention; hence, any further decrease in anxiety might be hard to detect. Furthermore, as for self-efficacy, the intervention was not designed to reduce anxiety but to improve students' learning behavior. A direct effect of the training therefore cannot be expected; rather a reduction of anxiety after a longer period of time could be assumed once improved learning behavior has also led to an increase in achievement and when students have realized that through the application of learning strategies they can actively control their learning process (cf. Pekrun, 2006; Weiner, 1985).

Several limitations should be noted. The relatively small number of underachievers made it hard to assess intervention results, especially regarding the differential effects for underachievers and achievers. Variances in the learning-journal measures were rather small, also making it hard to detect differences. Nevertheless, the inclusion of daily measurements of learning behavior and emotions has a clear advantage over questionnaires, as the daily

learning-journal information measures effects in an ecologically valid way and has a greater sensitivity to changes than pre-/post-test questionnaires (Zimmerman, 2008). Effects from the measures of self-assessment and strategy monitoring corroborate the importance of such measures. Future research could therefore include more process-specific methods of evaluation. Furthermore, the sustainability of interventions on underachievement that target students' learning behavior needs to be investigated and the interventions' effects on performance and other variables such as motivation and emotions should be examined.

This study shows that gifted underachievers and gifted achievers can simultaneously profit from interventions which can be implemented in regular classroom settings. The intervention outlined in this study can be also implemented in the context of special pull-out programs, however. Smaller group sizes and a focus on gifted students alone might increase the outcome of the intervention, especially when frequent individual feedback on students' learning processes is provided. While all learning strategies in the training program are important and can be enhanced, the proceduralization of monitoring seems to be especially important for underachievers. Successful proceduralization of monitoring might help them to profit more from learning activities and, finally, to transform more of their potential into achievement.

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