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LINKING TEMPERAMENT WITH MOTIVATION

Reward and punishment sensitivities as predictors of students' achievement goal orientations and motivational appraisals

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Abstract

The purpose of this thesis was to increase understanding about the influence temperamental reward and punishment sensitivities may exert on motivation in a learning context. Following theory and findings from temperament research, reward sensitivity was viewed as differentiated into dimensions defined by the source of reward. Accordingly, an instrument with scales for measuring punishment sensitivity and two main dimensions of reward sensitivity, compiled from items in previous temperament research, was taken into use and validated. Motivation was approached as students' relatively stable motivational tendencies (i.e., achievement goal orientations), and appraisals of domain- and course-specific interest, strain, and effort.

The thesis comprises three original articles, reporting research conducted among students of different ages and educational stages. Two of the articles consist of two studies utilising different data sets. In Article I, the dimensional structure of temperamental sensitivities was examined among general upper-secondary students (Study 1; $N = 157$) and university students (Study 2; $N = 506$). Further, in Study 2, the predictive effects of reward and punishment sensitivities on achievement goal orientations (mastery-intrinsic, mastery-extrinsic, performance-approach, performance-avoidance, work-avoidance) were also inspected. In Article II, the developmental interrelationships between temperamental sensitivities and achievement goal orientations (mastery, performance-approach, performance-avoidance, work-avoidance) were followed over the first three years of elementary school ($N = 212$). Finally, in Article III, the impact of temperamental sensitivities on appraisals of interest, strain, and effort was investigated among eighth-graders in the domain of mathematics (Study 1; $N = 268$), and over the duration of a course in four different subjects among general upper-secondary students (Study 2; $N = 155$).

Variable-centred methodological approaches revealed the following findings. Firstly, factor analyses confirmed the assumed factorial structure of punishment sensitivity and two main dimensions of reward sensitivity, namely, interindividual reward sensitivity and intraindividual reward sensitivity. Interindividual reward is defined as being derived from other people's perceived or actual attitudes and actions, such as attention or praise, whereas the source of intraindividual reward is within the individual, in their own inner states and actions, such as enthusiasm and excitement over one's own successes, and enjoyment of and seeking out novelty.

Secondly, in all studies, a pattern emerged showing the temperamental sensitivities to be associated with motivation in a consistent fashion, regardless of the age of the participants. Interindividual reward sensitivity was connected with lower mastery strivings, higher concerns over the adequacy of one's performance respective to others (i.e., performance-approach and performance-avoidance orientations) and work avoidance, as well as with higher psychological strain in the course context. Likewise, punishment sensitivity, although somewhat less related to motivation than expected, showed links with heightened performance concerns and higher experiences of strain in the domain context. In contrast, intraindividual reward sensitivity was found to be associated with higher mastery strivings as well as higher interest appraisals and willingness to exert effort.

Overall, the findings support considering reward sensitivity as comprising dimensions based on the source of reward, and indicate that temperamental sensitivities have a role in guiding motivation in adaptive and maladaptive ways, academically and as regards well-being. It is therefore argued that these sensitivities should be taken into account as antecedents to students' motivation, in both educational research and practice.

Keywords: temperament, reward and punishment sensitivity, motivation, achievement goal orientations, interest, strain, effort

Anna Maria Rawlings

Temperamentin yhteys motivaatioon

Palkkio- ja rangaistusherkkyydet oppijoiden tavoiteorientaatioiden ja motivationaalisten kokemusten ennustajina

Tiivistelmä

Tämän väitöstutkimuksen tarkoituksena oli lisätä ymmärrystä siitä, miten yksilön temperamenttiin pohjaava herkkyys kokea ja tulkita ympäristönsään uhkia tai palkitsevien kokemusten mahdollisuuksia (ns. palkkio- ja rangaistusherkkyyden) suuntaa oppijoiden motivaatiota. Aiemman teorian ja temperamenttitutkimusten tulosten perusteella palkkioherkkyyden katsottiin jakautuvan ulottuvuuksiin, joita määrittää palkkion lähde. Aiempia instrumentteja hyödyntävä mittari rangaistusherkkyyden ja palkkioherkkyyden kahden pääulottuvuuden mittaamiseen otettiin väitöstutkimuksessa käyttöön ja sen pätevyyttä arvioitiin. Motivaatiota käsiteltiin sekä varsin pysyvinä motivationaalisina taipumuksina (ns. tavoiteorientaatiot) että aine- ja kurssikohtaisina kiinnostuksen ja kuormituksen kokemuksina sekä yrittämisenä.

Väitöstutkimus sisältää kolme tutkimusartikkelia, joissa raportoitu tutkimus on toteutettu eri-ikäisten oppijoiden parissa. Lisäksi kaksi tutkimusartikkeleista koostuu kahdesta osatutkimuksesta, joissa on käytetty eri tutkimusaineistoja. Ensimmäisessä tutkimusartikkelissa tarkasteltiin temperamenttiherkkyyksien ulottuvuuksia lukiolaisten (osatutkimus 1; $N = 157$) ja yliopisto-opiskelijoiden (osatutkimus 2; $N = 506$) parissa. Osatutkimus 2:ssa tutkittiin myös, miten palkkio- ja rangaistusherkkyydet ennustavat tavoiteorientaatioita (oppimisorientaatio, saavutusorientaatio, suoritus-lähestymisorientaatio, suoritus-välttämisorientaatio, välttämisorientaatio). Toisessa tutkimusartikkelissa tutkittiin temperamenttiherkkyyksien ja tavoiteorientaatioiden (oppimisorientaatio, suoritus-lähestymisorientaatio, suoritus-välttämisorientaatio, välttämisorientaatio) kehityksellisiä yhteyksiä kolmen ensimmäisen kouluvuoden ajan alakoululaisten ($N = 212$) parissa. Kolmannessa tutkimusartikkelissa temperamenttiherkkyyksien yhteyttä kiinnostukseen, psykologiseen kuormitukseen ja yrittämiseen tarkasteltiin kahdeksaluokkalaisten (osatutkimus 1; $N = 268$) parissa matematiikan oppiai-

neessa, sekä lukiolaisten (osatutkimus 2; $N = 155$) parissa neljän eri oppiaineen ensimmäisellä kurssilla.

Tulokset tukivat temperamentin ja etenkin palkkioherkkyyden ulottuvuuksista asetettua oletusta. Palkkioherkkyyden todettiin jakautuvan kahdeksi pääulottuvuudeksi, joista herkkyydessä sosiaaliselle palkkiolle (ns. interindividuaalinen palkkioherkkyyys) palkkion lähteenä ovat muiden ihmisten suhtautuminen, asenteet ja teot (esim. huomion kohteena oleminen, kehut). Sisäistä palkkioherkkyyttä (ns. intraindividuaalinen palkkioherkkyyys) sen sijaan määrittää omien toimien ja tunnetilojen kokeminen palkitsevana (esim. uutuushakuisuus, innostuneisuus omista tekemisistä ja onnistumisista).

Havainnot temperamenttiherkkyyksien yhteyksistä motivaatioon toistuvat samansuuntaisina kaikissa artikkeleissa ja niiden osatutkimuksissa, osallistujien iästä riippumatta. Interindividuaalisen palkkioherkkyyden todettiin olevan motivaation ja hyvinvoinnin kannalta ongelmallinen; tämä herkkyyys oli kielteisesti yhteydessä oppimisen tavoitteluun mutta myönteisesti sekä suoritushakuisuuteen että suoritusten ja koulutyön tai opiskelun välttelyyn, ja lisäksi korkeampaan kuormittuneisuuteen kurssikontekstissa. Rangaistusherkkyyden puolestaan todettiin olevan yhteydessä korkeampaan kuormittuneisuuteen matematiikan oppiaineessa, ja suoritushakuisuuteen sekä etenkin suoritusten välttelyyn. Sen sijaan intraindividuaalisen palkkioherkkyyden ja niin oppimishakuisuuden kuin kiinnostuksen ja yrittämisenkin yhteydet olivat myönteisiä, ja tämä herkkyyys vaikuttaisi siten motivaatiota ja hyvinvointia tukevalta.

Kaikkineen löydökset tukevat palkkioherkkyyksien erottelua palkkion lähteen mukaan tutkimuksessa, ja viittaavat temperamenttiherkkyyksien merkitykseen motivaatiota ohjaavana tekijänä, sekä myönteisillä että kielteisillä tavoilla niin akateemisesti kuin hyvinvoinninkin kannalta. Näiden herkkyyksien merkitys oppijoiden motivaatiota ennakoivina tekijöinä tulisi-kin huomioida niin tutkimuksessa kuin kasvatuksen kentälläkin.

Avainsanat: temperamentti, palkkio- ja rangaistusherkkyyys, motivaatio, tavoiteorientaatiot, kiinnostus, kuormitus, yrittäminen

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*I am not yet born; provide me
With water to dandle me, grass to grow for me, trees to talk
to me, sky to sing to me, birds and a white light
in the back of my mind to guide me.*

(from *Prayer Before Birth*, by Louis MacNeice)

Helsinki, 22.6.2021

Anna Maria Rawlings

Dedicated to my sons

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ORIGINAL PUBLICATIONS

This thesis is based on the following articles, which are referred to in the text by their Roman numerals (Articles I–III).

- Article I** Rawlings, A. M., Tapola, A., & Niemivirta, M. (2017). Predictive effects of temperament on motivation. *International Journal of Educational Psychology*, 6(2), 148-182. doi: 10.17583/ijep.2017.2414
- Article II** Rawlings, A.M., Tapola, A., & Niemivirta, M. (2020). Longitudinal predictions between temperament and motivation in the early school years. *European Journal of Psychology of Education* 35(2), 451-475. doi: 10.1007/s10212-019-00432-w
- Article III** Rawlings, A.M., Tapola, A., & Niemivirta, M. (2021). Temperamental sensitivities differentially linked with interest, strain, and effort appraisals. *Frontiers in Psychology*, 11:551806. doi: 10.3389/fpsyg.2020.551806

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The thesis was carried out within Professor Markku Niemivirta's Motivation, Learning, and Well-Being (MoLeWe) research group, and as part of Prof. Niemivirta's and Dr Anna Tapola's projects. Anna Maria Rawlings was first and corresponding author in each of the three articles. Rawlings conducted all data analyses for all articles, and took the main responsibility for writing the manuscripts and the revision processes. She also organised and carried out the latter two years of data collection for Article II, and contributed to the study design of Article III. Dr Tapola contributed to the writing of the three manuscripts and to the study designs, and supported the revision processes. Prof. Niemivirta outlined the research designs, provided support for the data analyses, contributed to the writing of the three manuscripts, and supported the revision processes.

1. INTRODUCTION

Students' academic aims, as well as their interpretations and experiences of and responses to the same learning context, are known to vary considerably: what one student holds as their ultimate goal, another may want to avoid at all cost, and situations that entice and excite one student may, in another, evoke worry and the desire to withdraw into their shell and hide (e.g., Rothbart & Jones, 1998). In this thesis, I propose that temperament, the neurobiological basis of personality that is observable already from infancy (Rothbart, 2007), may contribute to the formation and establishment of such differences.

Temperament guides the relationship individuals have with their environment. It influences which environmental cues catch their attention and hold their focus, how they interpret situations and events, and what is particularly likely to incite a response from them, as well as how these responses are characteristically expressed (e.g., Rothbart, 2007; Rothbart & Hwang, 2005). For example, individuals may be inclined towards noting the appealing promise of possible rewards in their environment and enthusiastically approach them, or conversely, they may be given to sense cues of potential threats and warily avoid them. Such differences in the tendency to perceive and approach rewards or avoid threats are considered as illustrating a fundamental distinction in temperament (Corr et al., 2013) defined as reward and punishment sensitivity (e.g., Rothbart & Hwang, 2005; Torrubia et al., 2001).

Individual differences in perceiving environmental cues as potentially threatening and therefore to be avoided, or as promising rewards to be approached, are also reflected in students' motivation (see, e.g., Niemivirta et al., 2019). If we consider motivation as *the energisation and direction of behaviour* (Pintrich, 2003, p. 669), and the study of motivation as an examination of what it is that moves individuals into action and towards which end(s) their actions are directed, reward and punishment sensitivities appear as a deeply motivational construct. Indeed, these sensitivities are considered to be important motivators of approach and avoidance behaviour (Rothbart & Hwang, 2005), due to the way they direct attention and interpretation as well as shape emotional and behavioural responses and patterns. In this thesis, motivation is approached from two viewpoints: achievement goals, or "*the purposes of achievement behaviour*" (Ames, 1992, p. 261) defined by the reason(s) for pursuing an achievement task and the

standards or criteria by which competence or success is evaluated (Pintrich, 2000), and motivational appraisals, or the motivationally salient responses arising from an evaluation of the demands experienced in a learning context in relation to one's coping potential (see, Jamieson, 2017; Lazarus & Smith, 1988; Smith & Lazarus, 1993).

Connections between achievement-related goals and approach and avoidance temperaments have been empirically observed (e.g., Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002; Farrell & Walker, 2019), but in spite of the evident importance of this discovery, research examining the relationship between temperament and motivation in educational settings has remained sparse, even surprisingly so. Furthermore, particularly the findings from temperament research regarding the dimensionality of reward sensitivity (e.g., Carver & White, 1994; Colder et al., 2011; Colder & O'Connor, 2004; Corr, 2016; Corr & Cooper, 2016; Krupić, Corr, et al., 2016; Rothbart, 2007; Torrubia et al., 2001) have been rather neglected in the field of motivation. The relatively sparse previous research into the connections between temperament and motivation has largely utilised the approach-avoidance temperament conceptualisation (e.g., Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002, 2010) of temperament that is conceptually close to reward and punishment sensitivity, but without differentiating dimensions based on sensitivity to qualitatively different sources of reward. Including the possibility of these multiple reward dimensions influencing motivation in differential ways is also at the heart of the present thesis.

If individuals' temperament does shape their motivation in a learning context in both positive and negative ways, some students could be rendered at a disadvantage due to their inherent characteristics, which should be taken into account in designing, planning, and carrying out educational practices (e.g., Rothbart & Jones, 1998). My aim, therefore, is to add to our understanding of these connections, and address some of the gaps in current knowledge. These include, firstly, individual differences in the kinds of rewards to which people may be sensitive (such as novelty, personal successes, or attention from others; e.g., Colder et al., 2011; Corr, 2016; Corr & Cooper, 2016), noted within research into temperament research, but largely unconsidered in studies on its impact on motivation in a learning context. Furthermore, studies into the relationship between temperament and motivation during the early school years are virtually lacking. Finally, existing research on the connections between temperament and motivation has focused mainly on achievement goals only (e.g., Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002). However, the way temperamental sensitivities

guide individuals' interpretations and experiences of their environment suggests they might also influence, for example, students' motivational appraisals in different learning contexts. These issues are addressed in three empirical articles examining these so far little-researched aspects of the linkages between temperament and motivation. A summary of the articles included in the thesis is given in Table 1.

1.1. Temperament

Temperament is described as being present at birth or observable from infancy, remaining relatively stable over time, and accounting, in part, for individual differences in affective and behavioural responses to the environment (Rothbart, 2007; Rothbart & Bates, 2006; see also, Elliot & Thrash, 2002). The stimuli to which an individual is particularly sensitive, their propensity for positive or negative affect, their threshold for affective responses being triggered, and the behavioural manifestations of these responses are all influenced by temperament (Rothbart, 2007; Rothbart & Hwang, 2005). Furthermore, the relationship between temperament and the environment also tends to be bi-directional, in other words, an individual's temperament, or more to the point, its manifestations affect the way others respond to them (e.g., Rothbart & Jones, 1998; Wachs & Kohnstamm, 2001; see also, Hamre & Pianta, 2005; O'Connor, 2010). In educational contexts, this in practice means that a student's temperament-related behaviour is likely to influence the way teachers perceive and respond to them, and also conversely, that different students will experience the teacher's actions and demands in different ways, depending on their temperamental sensitivities (see, e.g., McGrath & Van Bergen, 2015; Rudasill et al., 2013; Rudasill & Rimm-Kaufman, 2009; Viljaranta et al., 2015). An individual's temperament may, hence, have even far-reaching impact on their educational experiences.

1.1.1. Sensitivity to reward and punishment

Reward and punishment sensitivities are a central distinction of temperament describing relatively stable tendencies to perceive, focus on, and approach appetitive (reward sensitivity), or avoid or withdraw from perceived or actual aversive (punishment sensitivity) environmental cues (Corr, 2013; Rothbart & Hwang, 2005). They are considered fundamental motivators of approach and avoidance behaviour stemming from deep-rooted, likely innate individual differences in arousability or emotional

reactivity (e.g., Corr, 2013; Derryberry et al., 2003; Rothbart & Hwang, 2005), and while the sensitivities themselves are seen as universal, interindividual differences are thought to exist in their relative emphasis, or the propensity for them (Corr et al., 2013).

This distinction into reward and punishment sensitivity is recognised in a number of “neighbouring”, theoretically similar and to various extents overlapping conceptualisations (for overview, see, e.g., Rothbart & Bates, 2006; Rothbart & Hwang, 2005; Slobodskaya & Kuznetsova, 2013). In this Chapter, I will outline conceptualisations describing these core components of temperament that are particularly relevant for the present research.

The behavioural inhibition and behavioural approach system (BIS/BAS) is one of the most widely used conceptualisations of temperament, grounded in the neuroscientific reinforcement sensitivity theory (RST) (Gray & McNaughton, 2003). The conceptualisation describes two “negative” avoidance systems and one “positive” approach system (Corr, 2013; Corr & Cooper, 2016). Of the avoidance systems, the Fight-Flight-Freeze System (FFFS) is related to “pure” avoidance, and governs responses to cues of fear, threat, or punishment that can be avoided. The Behavioural Inhibition System (BIS), in turn, governs behavioural inhibition, worry-proneness, and anxious rumination triggered by goal conflict arising from perceiving threat that cannot be avoided and may, hence, have to be approached (Corr, 2013; Corr & Cooper, 2016; Gomez et al., 2016, 2020). In practical terms, the BIS function might mean having the inclination to approach a possible reward, while simultaneously perceiving and experiencing a need to avoid potential danger (DeYoung, 2010).

Further, the appetitive Behavioural Approach System (BAS) is related to the anticipation and approaching of rewards, and has until quite recently remained fairly sparsely theorised (Corr & Cooper, 2016). Although originally conceptualised as unidimensional, the BAS is now considered as encompassing different reward-responsivity processes (Corr & Cooper, 2016), and has been described as “*a global approach system ... best seen as operating with goals as opposed to acts or actions*” (Corr & McNaughton, 2012, p. 2347). From an evolutionary point of view, it has been suggested that as different goals may be potentially adaptive in the complex human environment, there is a “demand” for different, BAS-related approach strategies (Corr et al., 2013; Krupić, Gračanin, et al., 2016).

Another well-known temperament system describes biologically-based differences in reactivity and self-regulation (e.g., Rothbart & Bates, 2006). These dimensions have been examined among different age groups, ranging

from infancy (Rothbart, 1981, 1986) and childhood (Rothbart et al., 2001) through adolescence (Capaldi & Rothbart, 1992) to adulthood (D. E. Evans & Rothbart, 2007). Reactivity covers both appetitive and aversive tendencies, labelled surgency/extraversion and fear/negative affectivity, respectively. Surgency describes high activity level, approach tendencies, and positive affect, and fear/negative affectivity the tendency for avoidance, inhibition, or withdrawal as well as negative affect, in particular in response to novelty or challenge (e.g., Rothbart et al., 2001; Rothbart & Jones, 1998). The self-regulative dimension, effortful control, is described as a temperament factor that allows the individual to suppress and direct behavioural responses stemming from the affect-driven surgency/extraversion and fear/negative affectivity (Rothbart et al., 2003). Unlike the more primary dimensions of surgency and fear, which are considered to be present from infancy onwards at levels characteristic to the individual, Rothbart and colleagues maintain that effortful control continues to develop later, even during the first school years (Rothbart & Jones, 1998); further, its development can be supported with, for example, pedagogically sensitive teaching practices.

Another, psychobiological conceptualisation of temperament (Cloninger et al., 1993) has been used particularly in the field of clinical psychology and psychiatry, in connection with, for example, eating disorders (Fassino et al., 2002) or depression (Hansenne et al., 1999). A thorough examination of this rather extensive body of work is not feasible in the context of the present thesis. However, in brief, the conceptualisation describes four dimensions of temperament, defined as being heritable and observable from early childhood, and three character dimensions, which develop in the interaction of the temperament dimensions and the environment (Cloninger et al., 1993; Mardaga & Hansenne, 2007). For the purposes of this thesis, it is sufficient to focus on the temperament dimensions. The four dimensions comprise one aversive punishment sensitivity tendency, namely, harm avoidance, which is associated with anticipatory worry about potential future problems, and passive avoidance displayed as fear of uncertainty and shyness of unknown people. Further, the three appetitive reward sensitive tendencies include novelty seeking, characterised by the tendency of responding to novelty with exploration, impulsive decision-making, and strong approach reactions to cues of reward; reward dependence manifesting as dependence on others' approval and social attachment; and persistence, describing perseverance in spite of frustration and/or fatigue.

Finally, the approach and avoidance temperament conceptualisation (Elliot & Thrash, 2002) is grounded on an examination and classification of numerous approaches to temperament, which the authors characterise as trait adjective, comprising Neuroticism and Extraversion (Eysenck & Eysenck, 1985; McCrae & Costa, 1987); affective dispositions, consisting of positive/negative emotionality (Tellegen, 1985; Watson & Clark, 1997); and motivational systems, namely, the BIS and the BAS (Gray & McNaughton, 2003). The BAS, extraversion, and positive emotionality share core components that “collate” together to form the approach temperament, and the BIS, neuroticism, and negative emotionality, respectively, together form the avoidance temperament (Elliot & Thrash, 2002). This approach-avoidance temperament structure has been verified in both exploratory (Elliot & Thrash, 2002) and confirmatory (Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002) factor analyses.

The approach and avoidance temperaments are described by Elliot and Thrash (2010) as differing from their constituent approaches in a number of ways. Firstly, they are said to emphasise the psychological processes underlying behaviour, whereas extraversion/neuroticism describe phenotypic expressions of it; secondly, they focus on motivation (defined as affective reactivity, perceptual vigilance, and behavioural inclination) rather than affective experience, as do positive/negative emotionality; and thirdly, they are connected to a broader set of interacting neuroanatomical structures and neurophysiological processes, and are elicited by a broader range of stimuli, than the BAS and the BIS. The BAS and the BIS, however, appear as the most central aspect of the approach-avoidance temperament conceptualisation, as the authors describe it as an “extension” of the BAS and the BIS (Elliot & Thrash, 2002).

1.1.2. Functions and dimensionalities of temperamental sensitivities

Reward sensitivity in particular is, in many if not most conceptualisations, considered as comprising dimensions with differing functions. For example, in current research, the dimensions of BAS are considered as based on processes describing incentive motivation (anticipation of rewards, planning and working towards attaining them; “future-orientation”) on the one hand, and pleasure experience components (instant gratification, sensation-seeking; “now-focus”; Corr & Cooper, 2016; Heym et al., 2008; Satchell et al., 2017), on the other.

Cloninger and colleagues’ (1993) dimensions of temperament, in turn, are described through preconceptual learning biases. With learning defined

as information processing, the dimensions are seen as involving automatic responses to perceptual stimuli. Novelty seeking is here described as a bias for initiation or activation of behaviours, and reward dependence for the continuation of ongoing behaviour. Further, harm avoidance is seen as a bias for inhibition or cessation of behaviours; persistence was originally conceptualised as part of reward dependence, but was found in factor analyses to be uncorrelated to its other constituent aspects, instead emerging consistently as a separate factor.

However the dimensions are conceptualised, it appears clear that individuals differ in what they perceive as signals of threat of punishment or possibility of reward (Corr, 2013). This means, firstly, that the same stimulus (e.g., the company of other people; Corr, 2013; novelty; Carver & White, 1994; Torrubia et al., 2001) can be perceived as either, depending on the individual's sensitivities. Secondly, individual differences are likely to exist also within reward sensitivity, in other words, in the kinds of rewards to which individuals might be sensitive (see, e.g., Corr & Cooper, 2016).

To illustrate, social approval and attention is seen as describing an aspect of reward sensitivity (Cloninger et al., 1993; see also, Colder & O'Connor, 2004; Colder et al., 2011; Corr et al., 2013; Torrubia et al., 2001), as is novelty-seeking (Carver & White, 1994; Cloninger et al., 1993; Corr & Cooper, 2016; Rothbart, 2007). However, attaining the former reward (attention and approval) is clearly dependent on the actions and attitudes of other people, whereas the latter (novel experiences) is, or at least might be, independent of them. It appears possible that a person with a heightened positive responsiveness for novelty, for instance, might not place equal emphasis on gaining others' attention, and vice versa. Moreover, punishment sensitivity is linked with an aversion to being the centre of attention (e.g., through speaking in public; Colder & O'Connor, 2004; Torrubia et al., 2001) and a tendency for social anxiety (Kingsbury et al., 2013), especially in novel or unexpected situations (Torrubia et al., 2001). Hence, someone psychologically prone to punishment sensitivity might experience the aforementioned "rewards" not as rewarding, but rather as an anxiety-inducing threat to their well-being.

As to the differentiation of fear and anxiety systems (i.e., FFFS and BIS; e.g., Corr & Cooper, 2016), situations requiring an active avoidance response (e.g., actual physical escape or defensive attack) are rather rare in individuals' day-to-day lives, whereas "everyday" fears and threat experiences, brought by conflicting goals (e.g., hoping to appear smart and attractive, while fearing social rejection and wishing to avoid it) and inciting

anxiety, inhibition/withdrawal, and/or passive avoidance, are fairly commonplace (see, DeYoung, 2010). Such conflicts can also be seen as a kind of punishment (see, Matton et al., 2013). Further, punishment sensitivity has been seen as a “product” of the combined activity of the FFFS and BIS (Hundt et al., 2013). Hence, while individual differences in sensitivity to fearfulness are likely to exist (Corr & McNaughton, 2012), a unidimensional punishment sensitivity comprising anxiety and fear seems justified in fields such as educational sciences and motivation research.

1.1.3. Operationalisations

A number of empirical studies (e.g., Colder et al., 2011; Gomez et al., 2020) utilising different operationalisations (e.g., Carver & White, 1994; Corr & Cooper, 2016) have quite consistently shown the BAS to comprise a number of sub-dimensions. In fact, the multidimensionality of the BAS is widely accepted as psychometrically accurate in contemporary research, to the extent that considering it as a unidimensional construct has been actively discouraged (Corr, 2016; Corr & Cooper, 2016; Krupić, Corr, et al., 2016).

Several instruments have been created for measuring BIS/BAS (for overview, see, e.g., Corr, 2016), of which the Carver and White (1994) BIS/BAS scales have been the most widely used. These scales comprise one BIS dimension, reflecting worry, anxiety, and fear of failure, and three dimensions of BAS, describing strong positive responsiveness to personal successes or opportunities for reward (Reward Responsiveness; RR), persistent behaviour towards attaining rewards (Drive; D), and impulsive sensation- and novelty-seeking (Fun-Seeking; FS). While the reliability and validity of the scales have been shown to be good, the operationalisation has also been criticised for a lack of theoretical justification of the specific reward dimensions (Corr, 2016) and shortcomings in the internal consistency of at least the Drive dimension (i.e., some Drive items refer to being conscientious, which implies long-term planning, others to instant gratification; Heym et al., 2008), as well as the omission of a fear (i.e., FFFS) dimension (Corr, 2016).

Another widely-used instrument for assessing BIS/BAS is the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001). Although conceptualised as depicting a unidimensional sensitivity to reward (BAS), the instrument nevertheless includes items covering a wide range of reward sources. In fact, using an age-downward parent-report version of the SPSRQ in a study conducted among pre- and early adolescents, Colder and colleagues (2011) extracted four reward sensitivity

(BAS) dimensions, depicting competitive drive tendency, sensitivity to social approval, impulsivity/fun-seeking, and sensitivity to sensory reward, as well as both a fear/shyness (FFFS) and an anxiety (BIS) factor.

More recently, Corr and Cooper (2016) have introduced a theory-based operationalisation. The Reinforcement Sensitivity Theory of Personality Questionnaire (RSTP-Q; Corr & Cooper, 2016) comprises separate anxiety (BIS) and fear (FFFS) dimensions, as well as four dimensions of appetitive reward sensitivity tendencies (i.e., BAS). Of these, Reward Interest describes enjoying novelty and actively seeking it and/or other enjoyable activities, and Goal-Drive Persistence a long-term, or “future” orientation (see, Heym et al., 2008; Satchell et al., 2017) to achieving desired reward. Reward Reactivity and Impulsivity, in turn, reflect more immediate, “now-focused” (Satchell et al., 2017) sensation- and pleasure-seeking.

Compared with the BIS/BAS, the approach-avoidance temperament conceptualisation has received relatively little attention; to wit, while an Approach-Avoidance Temperament Questionnaire (ATQ; Elliot & Thrash, 2010) has been designed, studies utilising the conceptualisation have more often than not made use of other, previously established instruments. However, approach temperament being considered unidimensional appears a shortcoming of the conceptualisation, in light of current theorising on the multidimensional nature of BAS (Corr, 2016; Corr & Cooper, 2016; Krupić, Corr, et al., 2016).

1.2. Goal-theoretical perspective on motivation

Understanding, explaining, and predicting individuals’ behaviour from the point of view of their higher-order goals (Nicholls, 1989) is the starting point of the goal-theoretical study of motivation. Individuals’ goals influence their perceptions of the adaptiveness of environmental cues as well as subsequent action choices (so-called ecological approach; e.g., McArthur & Baron, 1983), and subjective experiences as well as overt actions are, hence, seen as differing in predictable ways, when goals are different (Nicholls, 1984). Consequently, knowing what individuals want and believe – in other words, what their goals are, and the information they have of a situation – facilitates predicting their behaviour (Dennett, 1978/1998). An awareness of individuals’ goals also enables seeing their actions and interpretations of situations as rational and meaningful (Nicholls et al., 1989), although it is important to note that “rational behaviour” does not, always or necessarily,

imply “conscious behaviour” (Nicholls et al., 1989), and individuals are not expected to be always consciously aware of their goals (Dennett, 1978/1998).

1.2.1. Mastery and performance goals – focusing on the task or the self

Achievement behaviour has been described as having a twofold goal: to develop competence or ability, or to demonstrate it either to ourselves or to others, known respectively as task-involvement or ego-involvement (e.g., Butler, 1987, 1988; Nicholls, 1984) or as endorsing mastery (or learning) or performance (or ability) goals (e.g., Ames, 1992; Ames & Ames, 1981; Ames & Archer, 1988; Butler, 2006; Dweck, 1986). The terms mastery and performance goals are used in the present thesis.

The two goal categories of developing or demonstrating competence are seen as entwined with individuals’ conceptions of ability and definitions of success, and, ultimately, their view of the self. Individuals endorsing mastery goals tend to reference ability conceptions as well as perceptions of task difficulty and success to themselves and their (current) level of ability (e.g., Nicholls, 1984). In this case, a task is considered to be difficult, if failure is seen as possible or even likely; relatedly, ability is demonstrated and success defined as managing such a difficult task, and the chances of success can be improved with increased effort and subsequent learning (e.g., Ames & Ames, 1981; Nicholls, 1984). Conversely, endorsing performance goals describes a tendency to evaluate one’s ability and successful task performance against some normative reference group, such as classmates or fellow students (e.g., Nicholls, 1984). Here, learning and increased ability is not seen as sufficient basis for inferring one’s level of ability or competence, if reference group members are (perceived to be) at a similar or higher level, and exerting effort in order to succeed is interpreted not as a pathway to learning, but as indicating lack of ability (e.g., Dweck, 1986), if others are (perceived as) reaching similar results with lesser effort (e.g., Ames, 1992).

Young children have been considered as holding the task-involved view of ability (Nicholls, 1984). Over time, as a result of maturation, increased experience, and motivational influences gleaned from the environment, this tends to develop and change, so that low ability is no longer seen as due to a mere failure in mastering a task or improving one’s skills as much as one had hoped, which might be mended with further effort and subsequent learning, but rather, ability becomes viewed as a capacity, relative to that of other people (see, e.g., Butler, 1999). In other words, the individual’s focus may shift from mastering a skill to demonstrating their capability – to

performing, in relation to others, and, perhaps, also for them. However, it has been suggested that individuals are also more likely to adhere to the task-involved mastery “setting”, if environmental conditions and stimuli do not feed an atmosphere of testing individuals’ competence and rating them against each other, whereas a self-evaluative, socially-focused view of one’s self, effort, and performance is induced in learning situations in which interpersonal comparison and testing of valued skills in particular is the norm (Nicholls, 1984). Evidence from recent research supports this early assumption of the goals endorsed in a class being reflected in individuals’ goal adoption (Bardach et al., 2020).

In addition to the mastery/performance goal distinction, a further separation into approach and avoidance tendencies in achievement situations was suggested quite early on as this field of research was still emerging (e.g., Dweck, 1986; Nicholls, 1984). A difference was empirically noted between combinations of mastery or performance goals and individuals’ beliefs about their level of ability or skills: with learning (i.e., mastery) goals, skill-level beliefs and the possibility of public mistakes did not affect the goal of increasing competence, whereas endorsing performance goals while believing one’s skill level to be high was linked with preparedness to undertake challenging tasks, but not if this involved a possibility of public failure, while the combination of performance goals and low beliefs of one’s skill level resulted in withdrawal of effort (e.g., Elliott & Dweck, 1988). In further research, these findings evolved into identifying separate performance-approach and performance-avoidance goals (e.g., Elliot, 1999; Elliot & Church, 1997; Elliot & Harackiewicz, 1996), the former with the aim of demonstrating competence, usually in relation to others, the latter with the aim of avoiding demonstrating incompetence (e.g., Elliot & Thrash, 2001; Pintrich, 2000). This approach-avoidance separation is today widely acknowledged in goal-theoretical research, particularly with regard to the performance goal; while a similar approach-avoidance distinction has also been suggested regarding mastery goals (e.g., Elliot & McGregor, 2001; Pintrich, 2000), it remains less adopted and its usefulness somewhat under question (for review, see, e.g., Senko, 2016).

Furthermore, an even more fine-tuned definition of the performance-approach dimension has been suggested in recent research (e.g., Hulleman et al., 2010; Senko & Dawson, 2017; Senko & Tropiano, 2016), with a distinction made between considering performance-approach as demonstration of competence, or appearance goals, on the one hand, or as

outperforming others, or normative goals, on the other. However, more research into this matter is seen as needed (Elliot & Hulleman, 2017).

Finally, a work-avoidance goal has also been suggested, describing an indifferent and passive attitude towards academic work and the goal of refraining from effort exertion (e.g., Nicholls et al., 1985; Niemivirta, 2002). However, this dimension has – somewhat unfortunately – received considerably less attention than the mastery and performance goal dimensions, in spite of its evident relevance (e.g., Jagacinski et al., 2020; King & McInerney, 2014).

1.2.2. Achievement goals and goal orientations

In motivation research, achievement goals have been studied both as task-specific and situational, and as more generalised achievement goal orientations (for review, see, e.g., Senko, 2016). In both achievement goal and goal orientation conceptualisations, the central distinctions into mastery and performance goals as well as approach and avoidance dimensions are usually recognised.

A growing body of evidence links achievement goals and goal orientations with important phenomena, both educationally and as regards well-being. Overall, mastery goals and goal orientations have been linked with outcomes that are considered positive and adaptive, such as persistence (Sideridis & Kaplan, 2011) and self-regulation (Cellar et al., 2011), whereas avoidance goals and orientations have been associated rather consistently with negative, maladaptive outcomes. For example, work-avoidance been connected with academic disengagement (King, 2014), impaired achievement and negative well-being (King & McInerney, 2014), and maladaptive coping strategies (Skaalvik, 2018), and performance-avoidance goals and orientations, in turn, with negative affectivity, depression, and lower self-esteem (Sideridis, 2005), and lower interest and grades (Barron & Harackiewicz, 2003). The evidence regarding performance-approach goals and orientations is mixed, as it has been linked, for example, with academic success (for review, see, Senko et al., 2011), but also with academic difficulties, such as outcome concerns impairing working memory, with a negative effect on cognitive performance (Crouzevalle & Butera, 2013), as well as emotional exhaustion and stress (Tuominen-Soini et al., 2008). It has been suggested that the way performance-approach is defined might explain some of the apparently contradictory findings, as outperforming others (“normative goals”) predicts, for example, high competence perceptions and self-regulation,

whereas demonstration of competence (“appearance goals”) is associated with self-handicapping and help-avoidance (for review, see, Senko & Dawson, 2017).

Furthermore, suggestions have begun to emerge from a relatively recent line of research regarding the influence achievement goals may have on social outcomes, in both positive and negative ways (e.g., Barrera & Schuster, 2018; Darnon et al., 2012; Gonçalves et al., 2017; Poortvliet & Darnon, 2010; Shin & Ryan, 2014). For example, students endorsing mastery goals may be perceived by peers as more attractive cooperation partners with a higher social status, while negative peer perceptions have been reported about students endorsing performance-approach goals (Barrera & Schuster, 2018), and students endorsing performance-avoidance goals have had a lower likelihood of being named as a friend by peers (Shin & Ryan, 2014).

In sum, the connections students’ goal adoption have with academic and well-being outcomes speak of their broad importance, which in turn, makes evident the salience of exploring and perhaps identifying some of their potential antecedents. As temperamental sensitivities influence, even instigate motivated behaviour (e.g., Corr et al., 2013; Derryberry et al., 2003; Rothbart & Hwang, 2005), it is plausible that they may also play a role in guiding students' goal adoption.

1.3. Motivational appraisals

Appraisals are a form of personal meaning-making, whereby an individual evaluates the significance and relevance of environmental circumstances as personally harmful or beneficial, as well as their (perceived or actual) coping resources (Lazarus & Smith, 1988; Smith & Lazarus, 1993). In the appraisal process, the individual reconciles their goals and beliefs with environmental realities, based on their conscious or tacit knowledge and understanding of them. If one’s coping resources are deemed as adequate, the environment or situation may be appraised as benign, and positive emotional reactions are likely to ensue. Conversely, when one is uncertain of one’s possibility to cope effectively with the demands one faces, the environment is viewed as threatening, and negative reactions, such as anxiety, may follow.

In other words, students have to balance the personal value and importance of their academic goals and the demands they face with the impact these have on their well-being (Boekaerts & Niemivirta, 2000). A

perceived discrepancy between the demands presented by an important goal and one's capacities to meet them may be appraised as a threat to one's well-being, which may lead to negative emotions, such as anxiety and stress, and academically detrimental coping strategies, such as avoidance (Boekaerts, 1993; Lazarus & Folkman, 1984; see also, Thompson et al., 2014). Conversely, a challenge appraisal, in other words, evaluating one's abilities and skill level as meeting task demands without excessive cost to one's well-being, may lead to positive emotions such as eagerness or excitement, a mastery mode of studying, and an intention to learn (e.g., LePine et al., 2004). In a practical sense, in an everyday classroom context, such appraisals of discrepancy and threat on the one hand, and challenge on the other, might manifest as experiences of strain, or interest and effort exertion, respectively.

1.3.1. Interest

Interest refers to a psychological state that motivates and guides behaviour, and is characterised by heightened attention, affect, and concentration, as well as a desire and tendency for exploration (Ainley, 2006; Hidi, 2006; Hidi & Renninger, 2006; Silvia et al., 2009). Research commonly differentiates individual interest, a fairly stable, established tendency for seeking out and re-engaging with the object of interest, developed over time and through repeated exposure and engagement, and situational interest, a momentary state of interest triggered by and experienced in relation to a given content, activity, or task (Hidi & Renninger, 2006). Whether individual and established or situational and momentary, interest is described as relational, in other words, as having an object of interest (Hidi, 2006) towards which the individual experiences interest.

While interest might be sparked by various triggers in the environment, one suggested explanation of how the experience of interest might be engendered involves appraisals of novelty and complexity, combined with self-evaluated coping potential (Silvia, 2005). In other words, encountering novel, complex content that regardless is viewed as something that can be comprehended (Silvia et al., 2009) – something experienced as “*unknown but knowable*” (Connelly, 2011, p. 624) – may be a factor contributing to the generation of interest; perhaps particularly so in people who are temperamentally more inclined to respond positively to novelty and approach rewards (see, Hidi, 2016).

1.3.2. Strain

An individual may appraise a stressful situation as harmful, threatening, and/or challenging (Lazarus, 1993). Threat appraisals centre on potential harms inducing negative emotions, such as fear or anxiety, whereas challenge appraisals focus on potential positive outcomes and are associated with positive emotions (Lazarus & Folkman, 1984). The term strain is used in this thesis to describe the stress response arising from an appraised discrepancy in an individual's (real or perceived) ability to cope with (real or perceived) environmental demands regarding something they are committed to or value, with the situation being experienced as harmful or as threatening their well-being (Boekaerts, 1993; Lazarus & Folkman, 1984; LePine et al., 2004; Strelau, 2001). Thus, experienced stress might or might not induce strain in response, depending on whether the stress, or in more practical terms, the situation causing it, is evaluated as a harmful threat or a (potentially) beneficial challenge (LePine et al., 2004).

Reward and punishment sensitivities, as primitive coping systems that underlie and guide more complex mechanisms of dealing with personal needs and environmental demands (Derryberry et al., 2003), are an antecedent moderating and contributing to stress experiences and coping with stress (Strelau, 2001). It appears theoretically plausible to assume that high levels of punishment sensitivity – defined, as it is, by heightened sensitivity to signals of threat – would increase the likelihood of a threat (as opposed to challenge) appraisal, and an ensuing strain response to a stressful situation. Empirical research supports this assumption, as linkages have been found between punishment sensitivity (or one of the similar concepts, such as BIS) and stress proneness (Heponiemi et al., 2003), higher anticipated and experienced levels of stress (Ravaja et al., 2006), and stress perceptions and avoidant coping (Williams et al., 2014). Also negative affect in achievement situations is associated with punishment sensitivity (Bjørnebekk, 2007), whereas responsiveness to reward has been linked with higher well-being (Taubitz et al., 2015) and tendency for pleasant affect (Heponiemi et al., 2003).

1.3.3. Effort

Students' willingness to exert effort in order to overcome obstacles and reach goals is a defining factor of what has variously been described as the intention to learn (Boekaerts, 1993) or motivation to learn (LePine et al., 2004). Learners have been found to experience higher motivation to learn –

and, thus, exhibit increased effort exertion – if and when they evaluate a stressful situation as a positive challenge, and, conversely, lower motivation to learn as well as decreased effort or even avoidance, if a stressful situation is experienced as a harmful hindrance (LePine et al., 2004). The tendency to perceive the potential of rewarding experiences and approach them – in other words, reward sensitivity – might be a factor guiding an individual towards a positive challenge interpretation of such situations.

1.3.4. Interrelationships of interest, strain, and effort

Interest, strain, and effort may be supportive or maladaptive for student well-being in themselves, but they are also likely to interact with each other. For example, interest draws an individual's attention and triggers positive energy (Hidi, 2006), and, together with the positive affect aroused by engagement in an interesting and hence rewarding activity, supports persistence in spite of possible difficulties encountered (Hidi & Renninger, 2006). Interest has been found to predict effort independently as well as in interaction with trait conscientiousness (Trautwein et al., 2015), and interest and effort have also predicted each other (Xu, 2018). Interest and positive affect may also serve as a buffer against negative emotions and stress, as focus on the activity itself may overcome frustration and feelings of inadequacy; however, failure in spite of effort may result in psychological strain (Boekaerts & Niemivirta, 2000). Furthermore, when strain and negative affect are activated, less mental energy may be left available for other cognitive processes, such as problem-solving and learning (Baumeister et al., 2007; Vohs et al., 2012).

Interest, effort, and affect could hence be seen as interacting in a mutually supporting or hindering motivational cycle. What is not yet fully understood are the underlying reasons for some students having the educationally more advantageous response of experiencing stressful situations, adversity, and even failure as an enjoyable challenge that serves to arouse their interest and increase effort expenditure, whereas others find these threatening, and tend to withdraw further effort. Students' motivational tendencies (Tapola & Niemivirta, 2008) and domain knowledge or skills (Boekaerts, 1993) are known to be contributing factors, but the role of more stable individual characteristics in guiding motivational appraisals is less understood. Sensitivity to reward or punishment, describing a deep-rooted process of assessing the potentially benign and rewarding, or harmful and threatening nature of environmental cues (Derryberry et al., 2003), influence the way individuals interpret in particular the affective

valence and motivational relevance of their environment and situations they encounter. Hence, these sensitivities appear as a potential dispositional factor influencing also students' interest, strain, and effort appraisals.

1.4. The present study

1.4.1. Temperament and motivation – theoretical linkages

In a learning environment, students typically face qualitatively different and also possibly conflicting goals and demands (Bürger & Schmitt, 2017). Further, they also bring with them various individual characteristics that may influence their goals as well as their interpretation of the learning context (Tapola & Niemivirta, 2008). Academic, or task-focused, goals of learning and successful performance may be offset by the need for ego protection and maintaining a sense of well-being in the face of (perceived) threat, for example, from failing in a task or otherwise losing face (Boekaerts, 1993; Boekaerts & Niemivirta, 2000; Colder et al., 2011; Colder & O'Connor, 2004; Derryberry et al., 2003; Rothbart & Hwang, 2005; Torrubia et al., 2001). Also, goals that may have become implicit and automatised through being set repeatedly and regularly (Boekaerts & Niemivirta, 2000) may become activated, and different learning situations near-automatically interpreted as being of a given type (e.g., interesting, stressful, difficult) based on previous appraisals (see, Lazarus & Smith, 1988), which may further reinforce the tendency to adopt, for example, task-focused or ego-protective goals.

In directing individuals' attention and shaping their emotional and behavioural responses and patterns as well as (conscious and subconscious) choices, reward and punishment sensitivities are as such a deeply motivational construct (Corr et al., 2013). They could be said to act as a filter for environmental cues, sifting out information evaluated as most relevant, although evaluated should not here be seen as an individual's conscious action, but rather as a habituated, often subconscious responding based on deep-rooted psychological tendencies (Corr et al., 2013). In fact, "individual's habituated, often subconscious responding" could be said to reflect, relatively closely, the functioning of both temperamental sensitivities as well as achievement goal orientations and motivational appraisals. However, temperament is considered to be innate or observable from infancy (e.g., Rothbart, 2007), whereas achievement goal orientations and motivational appraisals describe motivational tendencies and processes

that emerge and develop as a function of one's learning history (e.g., Covington, 2000; Jamieson, 2017; Nicholls et al., 1985; Shin & Ryan, 2014). Therefore, as temperament precedes the emergence of these motivational tendencies and processes over the course of an individual's development, temperamental sensitivities might be considered as guiding both the adoption of certain achievement goal orientations over others, and the propensity for motivational appraisals typical for an individual stemming from quite habitually evaluating a situation or context and its demands as positive/benign or stressful (see, e.g., Rothbart & Hwang, 2005).

Conceptually, temperamental sensitivities and achievement goal orientations are linked by approach-avoidance tendencies being central in both: the approach tendency characterises reward sensitivity as well as the mastery and performance-approach orientations, and the tendency of avoiding or withdrawing from perceived threat is typical of punishment sensitivity as well as the performance-avoidance orientation (e.g., Elliot & Covington, 2001; Elliot & Thrash, 2002). Further, the discomfort with performing in public and withdrawal from novel situations associated with punishment sensitivity (e.g., Bishop et al., 2003; Colder & O'Connor, 2004; Torrubia et al., 2001) is reflected in the focus on and avoidance of potential public failure that differentiates the performance-avoidance orientation from the performance-approach orientation (e.g., Elliot & Thrash, 2001).

Moreover, linkages exist also in the various differential sources of rewards individuals may be sensitive to, on the one hand, and what is considered as defining successful goal attainment, on the other. The aspect of reward sensitivity describing emphasised importance of social approval and attention (Colder et al., 2011; Torrubia et al., 2001) appears conceptually connected with the performance goal orientations, in which experiences of successful goal attainment is dependent on other people (e.g., Senko, 2016). Also, as teacher and peer support have been found to buffer against the emergence of the work-avoidance orientation (King & McInerney, 2014), there may be some connection between this orientation and heightened sensitivity to reward derived from others' acceptance and attention. Conversely, reward experiences or perceptions of successful goal orientation are not reliant on other people in the case of both sensitivity to reward derived from novelty and one's own actions and inner states (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Rothbart, 2007), and the mastery goal orientations (e.g., Senko, 2016).

1.4.2. Conceptualisation of the phenomena in the present research

The terms reward and punishment sensitivity have been widely used before in temperament research (e.g., Harrison et al., 2010; Hundt et al., 2013; Matton et al., 2013; Schreurs et al., 2014; Torrubia et al., 2001). In this thesis, the conceptualisation of these fundamental dimensions of temperament draws on the BAS, surgency/extraversion, and novelty-seeking and reward dependence conceptualisations (reward sensitivity), and on the BIS, negative affectivity, and harm avoidance conceptualisations (punishment sensitivity), outlined above in Chapter 1.1.1 (Cloninger et al., 1993; Corr, 2013; Gray & McNaughton, 2003; Rothbart, 2007; Rothbart & Bates, 2006). The approach and avoidance temperament conceptualisation (Elliot & Thrash, 2002), itself a “hybridised” construct grounded on other theorisations, has served more as a model of approaching the diverse field – of drawing together and synthesising analogous concepts.

In the research comprising this thesis, punishment sensitivity is conceptualised as proneness to perceive or experience environmental cues such as novelty (e.g., Rothbart et al., 2001; Rothbart & Jones, 1998) or challenge (Cloninger et al., 1993) as potentially threatening, and to respond to such cues of potential threat with discomfort, shyness, avoidance, and/or withdrawal (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Derryberry et al., 2003; Rothbart, 2007; Rothbart & Hwang, 2005; Torrubia et al., 2001). Reward sensitivity, in turn, is seen as depicting a tendency to perceive, focus on, and approach (potential) rewards, while following the view of a multi-dimensional reward sensitivity widely recognised in today's temperament research (e.g., Corr, 2016; Corr & Cooper, 2016; Gomez et al., 2020; Krupić, Corr, et al., 2016). The main distinction of these reward dimensions is grounded on differences in their source; namely, whether the rewards are interindividual, in other words, dependent on other people in that they are derived from other people's (perceived) attitudes and responses, such as attention or praise, or intraindividual, that is, unrelated to conspecifics as such, but rather stemming from one's own actions, experiences, and inner states, for instance, positive responsiveness to novelty. These dimensions, while not previously labelled with the terms inter- and intraindividual, are regardless grounded on previous operationalisations (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Rothbart, 2007).

As to motivation, the focus is, firstly, on achievement goal orientations, describing a disposition-like, stable tendency of preferring certain kinds of outcomes over others in educational settings (Niemivirta, 2002). The

conceptualisation applied in this thesis recognises intrinsically and extrinsically based dimensions of mastery goal orientation, approach and avoidance dimensions of performance goal orientation, and a work-avoidance orientation (Niemi-virta, 2002; Niemi-virta et al., 2019). Secondly, motivation is considered as interest, strain, and effort appraisals. Of these, interest is examined as the relatively stable and established individual interest, encompassing personal value and importance, emotional enjoyment, epistemic orientation, re-engagement and willingness to spend resources (Hidi, 2006; Hidi & Renninger, 2006; Renninger & Hidi, 2016; see also, Knogler, 2017), and as the more momentary situational interest, a state that may or may not be triggered by and experienced in relation to a given content, activity, or task (Hidi & Renninger, 2006), or, as in the present research, a given course (see, Fryer et al., 2016). Strain is conceptualised a stress response of experienced difficulty, exhaustion, and stress, following Lazarus and Folkman's (1984, p. 19) definition of psychological stress as "*a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being*". Finally, effort is seen as diligent, persistent work exerted in academic tasks, and trying one's best (Trautwein et al., 2015; Trautwein & Lüdtke, 2007).

1.4.3. Evidence of connections from previous research

Some previous findings, although relatively sparse, also support considering temperament as a potential antecedent to the motivational phenomena examined here. Achievement goal orientations have usually been observed to remain relatively stable over time and across domains (Niemi-virta et al., 2019; Tuominen et al., 2020), and their stability as well as dispositional nature (Pulkka & Niemi-virta, 2013; Tuominen-Soini et al., 2012) suggest a connection with deep-rooted individual characteristics, such as temperament. The properties of an individual are recognised as central also in directing the appraisal process (Lazarus & Folkman, 1984). Given the way reward and punishment sensitivities influence individuals' perceptions and interpretations of their environment and situations they encounter as personally beneficial, rewarding, and to be approached, or potentially threatening or harmful and therefore to be avoided, the sensitivities seem a potential, even likely individual difference factor guiding students' motivational appraisals (see, e.g., Derryberry et al., 2003).

Empirically, linkages have been uncovered between approach and avoidance temperaments and achievement goals, generally so that approach temperaments have been related to approach goals and avoidance temperament to avoidance goals (Bjørnebekk, 2007; Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002, 2010). However, some findings have been less straightforward, in that avoidance temperament has been found to predict performance-approach goals (Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002), and behavioural approach to predict performance-avoidance goals (Bjørnebekk, 2007). Suggested potential mechanisms behind these connections include the “approach-to-avoid” tactic (Elliot & Thrash, 2001) – in other words, a student would approach an achievement situation or challenge not as much due to a desire to succeed, but rather in order to avoid the threat potential failure might pose to their well-being or sense of self (Boekaerts & Niemivirta, 2000). Another reason for these somewhat contradictory findings might be that temperament has been considered without differentiating between reward sources. In this case, a more nuanced view of reward sensitivity may be helpful in clarifying these results, and support an increased understanding of the relationships between temperament and goal adoption.

Evidence from previous research speaks also of the possibility of links between certain aspects of temperamental sensitivities and interest, effort, and strain appraisals. As interest counteracts wariness and anxiety of novel situations and, instead, encourages exploration of them (Silvia, 2017), it may, together with the tendency to exert effort known to be related to interest (e.g., Hidi & Renninger, 2006), be more readily triggered in individuals who are temperamentally more inclined to respond positively to novelty and to approach rewards (see, Hidi, 2016). Conversely, punishment sensitivity, in disposing individuals to focus on and avoid potential threats, may divert attention from learning to concerns over one’s capacity to cope successfully, and might therefore hinder interest arousal. Further, relations have been observed between punishment sensitivity and higher stress proneness (Heponiemi et al., 2003) and between reward responsiveness and higher well-being (Taubitz et al., 2015). Punishment sensitivity may, consequently, predispose students to higher strain in the learning context, whereas reward sensitivity may buffer against it. Also, as discussed earlier in this Chapter, linkages have been observed between students’ temperament and their achievement goals (e.g., Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002, 2010), and achievement goals or goal orientations, in turn, have been found connected with students’ experiences of interest (Tapola et

al., 2013), strain (Tuominen-Soini et al., 2008), and effort expenditure (Hornstra et al., 2017).

As encountering novel and/or challenging situations and content could be seen as an integral part of the learning process and context, punishment sensitivity was expected to have motivationally rather maladaptive connections. Further, linkages have already been discovered between punishment sensitivity (or conceptualisations closely resembling or overlapping with it, such as avoidance temperament or BIS) and avoidance goals (Bjørnebekk, 2007; Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002, 2010), as well as stress (Heponiemi et al., 2003; Ravaja et al., 2006; Williams et al., 2014) and negative affect in achievement situations (Bjørnebekk, 2007), supporting the assumption about the maladaptive effects of punishment sensitivity.

The interindividual dimension of reward sensitivity has been somewhat overlooked in the field of motivation, and assumptions on its connections with motivation were, therefore, largely based on theorising and less backed by previous findings. It was deemed possible that a heightened sensitivity to rewards related to the external, social world and dependent on the (perceived) attitudes and responses of other people might be linked with ego-protection, stress, and task-avoidance (see, Boekaerts, 1993; Boekaerts & Niemivirta, 2000), and might hence make students more prone to strive for relative success (i.e., being better than others; see, Colder & O'Connor, 2004; Torrubia et al., 2001) in the academic context. Intraindividual reward sensitivity, in turn, was seen to reflect reward derived from one's own actions and novel experiences (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Rothbart, 2007). As finding novel situations and experiences enjoyable is also characteristic of interest (Silvia, 2017), which is known to be linked with mastery strivings (Tapola et al., 2013), intraindividual reward sensitivity was expected to support mastery motivation, interest, and effort, and to buffer against work-avoidance, as an inverse relationship with the tendency to avoid exerting effort and to experience low incentive value with regard to learning appeared likely.

1.4.4. Overall assumptions and general aim of the research

Studying the relationships outlined here has the potential of informing both researchers and educators of possible sources or antecedents of educationally adaptive and maladaptive responses to the learning environment. In practice, these linkages could mean that for different students, relatively “everyday” school situations may hold different

significance and trigger different processes. For example, for some students, situations such as those involving competition or outperforming others, or having to speak in front of others and thereby be the centre of attention, may be enjoyable and therefore worth seeking out, whereas others might experience them as extremely important and hence stressful, while yet others could perceive them as a threat to be avoided (see, e.g., Corr, 2013; Derryberry & Rothbart, 1997; Tapola & Niemivirta, 2008). Some achievement goal orientations and motivational appraisals are more adaptive academically and as regards well-being than others; increased understanding of the individual differences affecting their adoption or emergence therefore holds importance, as it may enable developing and adapting pedagogical practices and/or aspects of the learning environment so as to support the well-being as well as academic achievement of all students, regardless of their temperament.

Table 1. Overview of the original articles: Participants, main aims and variables, and analyses.

Article	Participants	Main aims	Main variables	Analyses
Article I Study 1	General upper-secondary school students (N = 157)	Validation of reward and punishment sensitivity questionnaire: factorial structure	<u>Temperamental sensitivities:</u> punishment sensitivity; interindividual reward sensitivity; intraindividual reward sensitivity	EFA
Article I Study 2	University students (N = 506)	Validation of reward and punishment sensitivity questionnaire: replication of factorial structure; predictions on achievement goal orientations	<u>Temperamental sensitivities:</u> punishment sensitivity; interindividual reward sensitivity; intraindividual reward sensitivity <u>Achievement goal orientations:</u> mastery-intrinsic orientation; mastery-extrinsic orientation; performance-approach orientation; performance-avoidance orientation; work-avoidance orientation	ESEM
Article II	Elementary-school students (N = 212)	Examining stability of and predictive interrelationships between temperamental sensitivities and achievement goal orientations from 1 st to 3 rd grade	<u>Temperamental sensitivities:</u> punishment sensitivity; interindividual reward sensitivity <u>Achievement goal orientations:</u> mastery orientation; performance-approach orientation; performance-avoidance orientation; work-avoidance orientation	PLS-SEM
Article III Study 1	Secondary-school students (N = 268)	Examining predictions of temperamental sensitivities on domain-specific motivational appraisals	<u>Temperamental sensitivities:</u> punishment sensitivity; interindividual reward sensitivity; intraindividual reward sensitivity <u>Motivational appraisals:</u> domain-specific interest, strain, effort [mathematics]	ESEM
Article III Study 2	General upper-secondary school students (N = 155)	Examining predictions of temperamental sensitivities on course-specific motivational appraisals	<u>Temperamental sensitivities:</u> punishment sensitivity; interindividual reward sensitivity; intraindividual reward sensitivity <u>Motivational appraisals:</u> course-specific interest, strain, effort [Finnish, Swedish, English, advanced syllabus level mathematics]	PLS-SEM

Note. EFA = Exploratory Factor Analysis; ESEM = Exploratory Structural Equation Modeling; PLS-SEM = Partial Least Squares Structural Equation Modeling.

2. AIMS AND METHODS

This dissertation comprises three original articles, referred to in the text as Articles I, II, and III. Further, Articles I and III include two studies, referred to as Study 1 and Study 2.

2.1. Main aims

The overarching aim of the research reported in this thesis was to increase understanding of the ways in which students' temperamental sensitivities could be seen as antecedents to their motivation in an academic context. Previous research has uncovered connections between students' goal setting and approach and avoidance temperaments (e.g., Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002), which conceptually resemble and, to some extent, overlap with the reward and punishment sensitivity conceptualisation of temperament adopted in the present research. However, in the field of motivation research, little attention has been paid to the potentially differential effects of individual differences in the kinds of rewards to which people may be sensitive, although these differences are recognised in temperament research (e.g., Colder et al., 2011; Corr & Cooper, 2016). Also, to date there has been little longitudinal research on the connections, and research during the early school years has been especially lacking. Finally, previous research into the temperament-motivation connections has largely considered motivation in terms of achievement goals only, although the way temperamental sensitivities direct individuals' experiences and interpretations of their environment suggests they might also guide their motivational appraisals in a learning context. Particularly with these gaps in current knowledge in mind, the research questions addressed in this thesis can be summed up as follows:

1. What kind of dimensionality can be empirically observed in temperamental sensitivity to reward and punishment, particularly regarding sensitivity to different kinds of rewards relevant in a learning context, among different age groups (Article I, Studies 1 and 2; Article III, Studies 1 and 2)?
2. How are dimensions of temperamental sensitivities and motivation in a learning context related

- a. to students' goal adoption (i.e., achievement goal orientations), both cross-sectionally (Article I, Study 2) and longitudinally (Article II)?
- b. to students' motivational appraisals of interest, effort, and strain (i) in a more general setting of a given domain (Article III, Study 1) and (ii) specifically in the context of courses in different subjects (Article III, Study 2)?

2.2. Context of the research: Finnish educational system

The compulsory years of the Finnish educational system include one year of pre-school (primary) education at age six, followed by nine years of comprehensive school, with elementary school comprising first through to sixth grades for students 7–12 years of age, and secondary school comprising seventh through to ninth grades for students 13–15 years of age. Additionally, nursery schools, catering for children from infancy to five years of age, are widely attended. Further, approximately 95 % of students continue from comprehensive school to 3–4 years of upper-secondary education, with a choice of either vocational education leading to a professional qualification, or more academically-focused general upper-secondary education leading to the national Matriculation Examination. The division of students between the two types of upper-secondary education is relatively even, or somewhat weighted in favour of general upper-secondary school as opposed to vocational education (e.g., 54 % to 40 % in 2019; Official Statistics of Finland, 2019). Education from primary through to upper-secondary and university-level is free.

2.3. Participants and procedures

The participants of the studies reported in the original articles represent different age groups and academic levels. In all five studies, the participating students were assured of the confidentiality of their responses. Participation was voluntary, and parental consent for data collection was obtained in the studies where participating students were minors (Study 1 of Article I; Article II; Studies 1 and 2 of Article III).

2.3.1. Article I (Study 1) and Article III (Study 2)

The participants of Study 1 of Article I and Study 2 of Article III were the entire age cohort ($N = 172$; due to absence, Study 1 of Article I effective $N =$

157, Study 2 of Article III effective $N = 155$; age 16–17; Study 1 of Article I girls 57 %, Study 2 of Article III girls 56.1 %) of students starting their studies in the autumn of 2013 at the only general upper-secondary school of a town in Central Finland (population approx. 17 700 in 2013). Note that while the participants in the two studies are largely the same, the two studies utilised data sets from different time points (end of school year, Study 1 of Article I; beginning of school year, Study 2 of Article III).

Paper-and-pencil questionnaires were administered by teachers at the beginning and towards the end of the school year, comprising various scales. Of these, the present thesis utilises the measurements for temperamental sensitivities (Study 1 of Article I; Study 2 of Article III) and individual interest in specific school subjects (Study 2 of Article III). For Study 2 of Article III, course teachers also administered paper-and-pencil questionnaires covering students' motivational appraisals of individual courses (1) in the early part of the course, when the students had had a chance to become acquainted with the course content and demands; and (2) immediately following the course exam. Finally, after the students had received their course grades, they were asked to rate their satisfaction in their performance. Course grades as well as final comprehensive school grades in each subject were retrieved from school records, and used as indicators of course achievement and previous achievement, respectively.

2.3.2. Article I (Study 2)

The participants of Study 2 of Article I were university students ($N = 506$; $M_{age} = 25.07$, $SD = 5.47$; women 86 %) from the fields of humanities, social sciences, and education. Participants were invited to take part in the study with an email containing a link to the online questionnaire covering their temperamental sensitivities and achievement goal orientations. Students' contact information was retrieved from university mailing lists.

2.3.3. Article II

Article II followed elementary school students from 17 classes in six schools in the metropolitan area in Finland for three years, from the first to the third grade ($N = 212$; at grade 1, age 7–8 years; at grade 2, age 8–9 years; at grade 3, age 9–10 years; girls 52.8 %). Teachers rated their students' temperamental sensitivities and achievement goal orientations using an online questionnaire during the spring term of each grade.

2.3.4. Article III (Study 1)

In Study 1 of Article III, the participants were eighth-grade students ($N = 268$, $M_{age} = 14.34$; girls 49.6 %) from twenty classes in seven secondary schools around Southern Finland. The students responded to a questionnaire measuring their temperamental sensitivities and mathematics-related interest, strain, and effort during the spring term of the eighth grade, and took a low-stakes mathematics test (Räsänen & Leino, 2005) during a mathematics class some weeks later, as a measure of their mathematics task performance. The students' most recent mathematics grades, used as an indicator of previous achievement, were obtained from their teachers.

2.4. Measures

All articles utilised a measure for temperamental sensitivities compiled from previous instruments described in more detail in Chapter 2.4.1, but some differences exist in its usage between the respective articles. Article II focused on punishment sensitivity and interindividual reward sensitivity (i.e., intraindividual reward sensitivity was not included). The terminology used for the dimensions of particularly the temperamental reward sensitivities has developed over the course of the research process. In this Summary, I am using the terminology that has become established after the publication of Article I.

2.4.1. Temperamental sensitivities

One of the two main aims of this dissertation was to examine the empirically observed dimensionality of temperamental sensitivities, in particular sensitivity to different kinds of rewards considered as potentially salient in a learning context. As a compiled measure was used for this purpose, it appears relevant to describe here the reasoning behind the compilation as well as the instrument itself.

Theoretical rationale behind temperamental sensitivities instrument

In research into temperament, punishment sensitivity has often been considered a unidimensional construct, covering shyness, discomfort, and withdrawal from or avoidance of difficult or novel situations (e.g., Carver & White, 1994; Colder et al., 2011; Torrubia et al., 2001), although it has also been stated that the shyness/anxiety and fear aspects should be treated as

separate dimensions, as they are considered to be governed by different neurobiological systems (e.g., Corr, 2016; Corr & Cooper, 2016). However, it has also been argued that the “fear” referred to in this instance refers to the kind of response to potentially life-threatening situations that are generally not part of the learning context (DeYoung, 2010). This is also the stance adopted in this dissertation, in line with previous research (e.g., Hundt et al., 2013; Slobodskaya & Kuznetsova, 2013; Torrubia et al., 2001). Conversely, reward sensitivity is widely considered as multidimensional (e.g., Carver & White, 1994; Cloninger et al., 1993; Corr & Cooper, 2016; Rothbart, 2007), and even in the instances where it has been treated as a unidimensional construct (e.g., Torrubia et al., 2001), the items used to measure it appear to suggest different sources of reward. The purpose of compiling an instrument, rather than using one of the existing instruments directly, was to enable examining the influence of differential sources of reward relevant to motivation in a learning context, with participants of various ages and at different stages of their academic careers, in as commensurate a way as possible. Items from previous instruments referring to appetitive stimuli not seen as adhering to this condition (e.g., monetary rewards and sexuality; Torrubia et al., 2001) were therefore excluded. The items included describe sources of and/or behavioural responses to rewards that can be categorised into two overall dimensions, namely, as having an internal, intraindividual source (one’s inner states, such as enthusiasm and excitement over own successes, enjoyment of and seeking out novelty; Carver & White, 1994; Cloninger et al., 1993; Rothbart et al., 2003); or an external source. Regarding the latter, external rewards could naturally also be quite concrete, but out of existing items, those pertaining to an interindividual source, that is, reward contingent on other people and their (perceived) actions and attitudes, such as being the centre of attention, impressing others, or receiving praise (Colder & O’Connor, 2004; Torrubia et al., 2001), were seen as particularly relevant for the learning context, in which everyday experiences can be heavily based on social interaction (Barrera & Schuster, 2018; Shin & Ryan, 2014).

The items for the measure for temperamental sensitivities were compiled from existing instruments and previous theorising (Carver & White, 1994; Cloninger et al., 1993; Colder & O’Connor, 2004; Rothbart, 2007; Torrubia et al., 2001), with a view of the items included being relevant in a learning environment in that they would represent situations and experiences relatively commonplace in it. The items for the punishment sensitivity scale were chosen so as to depict the defining features of this

dimension, namely, behavioural inhibition, shyness, discomfort, and sensitivity to failure (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Rothbart, 2007; Torrubia et al., 2001). The interindividual reward sensitivity scale sought to capture sensitivity for reward derived from and dependent on the actions and (perceived) attitudes of other people, such as their attention and praise, behaviourally potentially expressed also as a desire to impress others (Colder & O'Connor, 2004; Torrubia et al., 2001). The intraindividual reward sensitivity scale consisted of items covering enthusiasm, excitement, and enjoyment of novelty (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Rothbart, 2007).

Operationalisation

In Studies 1 and 2 of both Article I and Article III, the participants' temperamental sensitivities were measured using a self-report questionnaire. Punishment sensitivity (5 items, e.g., *"I feel very uncomfortable in new situations and places"*) was operationalised as a unidimensional construct describing the sensitivity to focus on certain environmental cues perceived as potentially threatening (typically those involving novel situations, places, or people; e.g., Colder & O'Connor, 2004; Torrubia et al., 2001), and the tendency to react to these cues with anxiety, worry, avoidance, or withdrawal. Reward sensitivity was operationalised as comprising two main dimensions. Interindividual reward sensitivity (4 items, e.g., *"I often do things just to be praised"*) refers to sensitivity to reward derived from an external source, namely, other people and their (perceived) responses and attitudes, such as gaining others' attention or receiving praise. Intraindividual reward sensitivity (5 items, e.g., *"I get excited about new things easily"*; *"I don't hold back my joy and enthusiasm when something nice happens to me"*) refers to sensitivity to reward derived from one's own actions and mental states, such as positive responsiveness to novelty or personal successes.

Article II focused on the predictive effects of interindividual reward sensitivity and punishment sensitivity. As data collection for Article II began when the participating students were first-graders, at which point Finnish school children are not yet expected to know how to read, the wording of the scale was modified to suit observer- rather than self-ratings (i.e., items described behavioural responses rather than personal experiences). Using teacher-ratings made it possible to ensure commensurate ratings throughout the three years of data collection.

2.4.2. Achievement goal orientations.

Articles I and II utilised a questionnaire measuring achievement goal orientations (Niemivirta, 2002) used in a growing body of recent research (see, e.g., Niemivirta et al., 2019). The conceptualisation recognises five orientations: mastery-intrinsic describes the goal of learning, where success is defined intrinsically, for example, in the form of developing competence and mastery or deepening understanding (3 items, e.g., “*I study in order to learn new things*”); mastery-extrinsic also includes the goal of mastery, but where success is defined according to external, absolute criteria, such as high grades (3 items, e.g., “*An important goal for me is to do well in my studies*”); performance-approach refers to the goal of demonstrating competence through outperforming others (3 items, e.g., “*An important goal for me in my studies is to do better than the other students*”); performance-avoidance indicates the goal of avoiding being judged incompetent by others, for example, due to public failure (3 items, e.g., “*I try to avoid situations in which I may fail or make mistakes*”); and work-avoidance, in which the goal is to minimise expending effort on schoolwork as much as possible (3 items, e.g., “*I try to get away with as little effort as possible in my studies*”).

To date, the measure has been used considerably less with students in their early school years. In addition to modifying the wording of the items to enable observer-rating, in Article II, mastery orientation was measured as a single dimension depicting the goal of learning, due to the young age of the participating students and formal criteria (i.e., grades) for measuring learning being scarcely used in the first years of school in the Finnish educational system.

2.4.3. Motivational appraisals and course outcomes

In Article III, the aim was to broaden understanding of the relationship between temperamental sensitivities and motivation beyond the goal-theoretical realm, namely, to examine the relationship between temperament and students’ interest, strain (i.e., stress and experienced difficulty), and effort (i.e., motivational appraisals). In Study 1 of Article III, this was done cross-sectionally in a domain-specific context, and longitudinally in a course-specific context in Study 2. Furthermore, in Study 2, subject interest was added as a predictor of the motivational appraisals, and the impact of temperament, subject interest, and the motivational

appraisals on course achievement and personal satisfaction in it (i.e., course outcomes) were also examined.

Study 1

In Study 1, interest was operationalised rather in-depth, to cover the core elements of individual interest (personal value and importance, emotional enjoyment, epistemic orientation, re-engagement and willingness to spend resources; Hidi, 2016; Hidi & Renninger, 2006; Renninger & Hidi, 2016; see also, Knogler, 2017). The scale (8 items, e.g., *“I am interested in math”*) was compiled from items used in previous research (Frenzel et al., 2010; Gottfried, 1985; Marsh et al., 2005). Strain (3 items, e.g., *“Studying math really stresses me”*) was operationalised in terms of indicators that reflect a challenge to students’ coping or well-being, such as difficulty, exhaustion, and stress (see, Lazarus & Folkman, 1984). Finally, effort (3 items; e.g., *“I always try to solve all math homework”*) was operationalised following Trautwein et al. (2009, 2015).

Study 2

The students’ motivational appraisals were measured twice, to enable examining their interrelationships, stability, and change: early on in the first course in each subject under study (t1), and again immediately following the course exam (t2). At both measurement points, participants rated their course-specific interest (3 items, e.g., *“The content of this course is / has been interesting”*), strain (4 items, e.g., *“This course is / has been stressful for me”*), and effort (3 items, e.g., *“I am putting / have put a lot of effort into this course”*).

After the course, once they had received their course grade, the participants rated their satisfaction in their performance (*“Do you feel you reached the goals you had set yourself? Did you do as well as you expected to?”*; single dichotomous item with *No* = 1, *Yes* = 2). Course grades were retrieved from school records and used as an indicator of course achievement.

2.5. Data analyses

Key aims of the present research were the validation of an instrument for measuring dimensions of temperamental sensitivities (Article I) and examining the ways these dimensions might predict aspects of motivation in a learning context (Study 2 of Article I, Articles II and III). It can, therefore, be said that the research presented in this thesis is exploratory although

grounded in theory, and this is reflected in the analytical methods employed.

2.5.1. Exploratory Structural Equation Modeling (ESEM)

An important point to consider regarding analytical methods is that temperamental sensitivities are seen as interacting with each other in the way they elicit behavioural effects, and therefore, variables used for assessing them are unlikely to be factorially “pure” (Corr & McNaughton, 2008; Marsh et al., 2014), in other words, to consist of items loading only onto one factor. Constricting cross-loadings to zero, as in structural equation modeling based on Confirmatory Factor Analysis (CFA-SEM), is considered problematic for many multidimensional constructs, as suppressing cross-loadings not very close to zero may artificially and even quite seriously inflate latent correlations of factors (Morin et al., 2013), potentially resulting in misinterpretation of the relationships between phenomena. Exploratory Structural Equation Modeling (ESEM) is seen as including many of the benefits of CFA-SEM (e.g., providing statistical criteria, such as significance tests and fit indices, for evaluating different factor structures), whilst allowing for cross-loadings that may reflect the very nature of the phenomena under study (Marsh et al., 2014; Morin et al., 2013). In a comparative study (Mai et al., 2018), ESEM has been recommended for use when cross-loadings between factors exist. Accordingly, the data for Article I and Study 1 of Article III were analysed using ESEM with Geomin rotation, using MPlus statistics software (Muthén & Muthén, 1998–2015).

Regarding examining and establishing model fit, the χ^2 goodness-of-fit statistic is widely used (e.g., Hu & Bentler, 1999), but it is also known to be sensitive to, for instance, sample size or minor deviations from normality (e.g., Morin et al., 2013). Therefore, the χ^2 statistic was complemented with other model fit indices in Article I, namely, the standardised root mean squared residual (SRMR; recommended cut-off value < .08), comparative fit index (CFI; values > .90 considered as acceptable, and > .95 as excellent fit to the data), and the root mean square of error approximation (RMSEA; values < .08 seen as indicating acceptable, and < .06 as good fit to the data) (see, Hu & Bentler, 1999; Morin et al., 2013).

2.5.2. Partial Least Squares Structural Equation Modeling (PLS-SEM)

The relatively complex models inherent in ESEM (i.e., each item is specified as loading on each factor, substantially adding to the sum total of

parameters in a model) may become problematic when the number is relatively small (see, Mai et al., 2018), and particularly so if the design also includes many multidimensional constructs. This was the case with Article II (which examined the interrelationships of six latent constructs over three measurement points) and Study 2 of Article III (where the model included two covariants, three latent temperament factors, and five dependent variables, of which the three latent variables were measured twice). Therefore, the analyses in Article II and Study 2 of Article III were conducted using Partial Least Squares structural equation modeling (PLS-SEM).

PLS-SEM is seen as a viable alternative to covariance-based structural equation modeling (CB-SEM) in the case of more exploratory studies (Hair et al., 2014) and when running a complex model on data with a small number (Sarstedt et al., 2017), also as it imposes less strict distributional assumptions on data (Sanchez, 2013). Unlike in CB-SEM, where the aim is said to be explanatory (i.e., estimating model parameters so as to produce an empirical covariance matrix with as close a fit as possible to the covariance matrix implied by the hypothetical model), in PLS-SEM, the aim is predictive (i.e., aiming for maximum explained variance of the endogenous variables) (Sarstedt et al., 2017). PLS-SEM is to date somewhat less common than CB-SEM in the field of educational psychology, but it has been successfully utilised in some recent studies, for example, predicting children's mathematical performance from early numeracy (Aunio & Niemivirta, 2010) and spontaneous focusing on numerosity (Hannula-Sormunen et al., 2015), or examining the relationships between university students' self-control, self-regulated learning, and course outcomes (Zhu et al., 2016).

PLS-SEM includes a measurement model, in which indicator variables (i.e., questionnaire items) are related to their expected latent variables, and a structural model, in which the latent variables are related to each other in the way specified in the hypothetical model. The analyses for both Article II and Study 2 of Article III were conducted using the “*plspm*” package (Sanchez et al., 2015) with R software version 3.2.3, with a centroid weighting scheme for estimating inner weights, and a bootstrapping procedure with 500 bootstrap samples for estimating parameter significance. The “*missForest*” package (Stekhoven, 2013), an iterative imputation method using a random number generator found to perform well in data settings with complex interactions and non-linear relations (Stekhoven & Buhlmann, 2012), was used to impute missing values.

Unlike CB-SEM, PLS-SEM does not have straightforward goodness-of-fit indices, but rather, model validity is established using a number of evaluation criteria that are considered together and in relation to each other (Hair et al., 2014). In Article II and Study 2 of Article III, this was done by following the guidelines set by Hair, Hult, Ringle, and Sarstedt (2014). Internal consistency reliability was evaluated first, using the composite reliability, with values .60–.70 considered adequate for exploratory research. Convergent validity was then examined, using the average variance extracted (AVE), which should be above .5, and indicator loadings, which should be significant and greater than .7. However, it should here be noted that as loadings lower than this are not uncommon in social sciences (Hair et al., 2014), the recommended practice is to remove indicators with a loading between .40 and .70 only, if the removal would increase either the composite reliability or the AVE above the threshold values. Finally, discriminant validity was established through indicators loadings on the intended constructs being greater than crossloadings on other constructs, and the square root of the AVE of each latent variable being higher than its correlation with other latent variables (so-called Fornell-Larcker criterion).

3. OVERVIEW OF THE ORIGINAL ARTICLES

The aims of this thesis – examining the relationships between temperamental reward and punishment sensitivities and motivation in a learning context, and the dimensionality of particularly the reward sensitivity – were pursued in three original articles, of which Articles I and III consisted of two studies. The participants in the five studies included in the three Articles represented four different age groups and educational levels, ranging from elementary-school students (Article II) to secondary (Study 1 of Article III), upper-secondary (Study 1 of Article I; Study 2 of Article III), and university students (Study 2 of Article I). Articles I and II focused on the linkages between temperament and achievement goal orientations, and Article III on the connections between temperament and motivational appraisals of interest, strain, and effort. Article II examined the relationships over the first three school years, and Study 2 of Article III over the duration of four courses in different subjects. The main results are summarised in Table 2. Descriptive statistics of the temperamental sensitivities and their intercorrelations within each Study are given in Table 3.

Table 2. Summary of the main results: Factorial structures and predictive effects.

Article	Factors	Predictions between temperamental sensitivities and motivation
Article I Study 1	SP	Not applicable ^a
	SRinter	
	SRintra (NS, PE)	
Article I Study 2	SP	SP positively predicted mastery-extrinsic, performance-approach, performance-avoidance orientations.
	SRinter	SRinter negatively predicted mastery-intrinsic orientation, and positively performance-approach, performance-avoidance, work-avoidance orientations.
	SRintra (NS, PE)	SRintra (NS) positively predicted mastery-intrinsic, mastery-extrinsic, performance-approach orientations, and negatively work-avoidance orientation. SRintra (PE) negatively predicted performance-approach, performance-avoidance orientations.
Article II	SP ^b	SP (t2) positively predicted performance-avoidance orientation (t3).
	SRinter ^b	SRinter (t1) negatively predicted mastery orientation (t2), which negatively predicted SRinter (t3). SRinter (t1) positively predicted performance-avoidance orientation (t2), and SRinter (t2) and performance-avoidance orientation (t2) positively predicted each other at (t3). Performance-approach orientation (t1) positively predicted SRinter (t2), which positively predicted performance-approach orientation (t3). Work-avoidance orientation (t2) positively predicted SRinter (t3).
Article III Study 1	SP	SP positively predicted mathematics strain.
	SRinter	
	SRintra (NS, PE)	SRintra (NS) positively predicted mathematics interest and mathematics effort.
Article III Study 2	SP	
	SRinter	SRinter positively predicted strain (Swedish, English) and negatively predicted effort (mathematics).
	SRintra	SRintra positively predicted interest (Finnish, Swedish) and effort (Finnish, Swedish, mathematics).

Note. ^a Predictive effects were not examined in Study 1 of Article I. ^b The intraindividual reward sensitivity dimension was not included in Article II.

SP = punishment sensitivity; SRinter = interindividual reward sensitivity; SRintra = intraindividual reward sensitivity; NS = novelty-seeking; PE = positive expressiveness. (t1), (t2), (t3) = 1st, 2nd, 3rd measurement points.

Table 3. Interrelationships and descriptive statistics of the temperamental sensitivities in all articles.

Article I ($N_{S1} = 157; N_{S2} = 506$)						
Variable (Scale)	1 (S1/S2)	2 (S1/S2)	3 (S1/S2)	$M_{S1} (SD_{S1})$	$M_{S2} (SD_{S2})$	
1 SP (1-7)	-			3.60 (1.28)	3.95 (1.27)	
2 SRinter (1-7)	.28/.03	-		3.10 (1.02)	3.45 (1.09)	
3 SRintra (NS) (1-7)	<i>-.46/-.49</i>	.05/.06	-	4.06 (1.22)	4.85 (1.17)	
4 SRintra (PE) (1-7)	<i>-.19/-.32</i>	.22/.17	.29/.32	4.56 (1.17)	5.12 (1.42)	
Article II ($N = 212$)						
Variable (Scale)	r_{t1}	r_{t2}	r_{t3}	$M_{t1} (SD_{t1})$	$M_{t2} (SD_{t2})$	$M_{t3} (SD_{t3})$
1 SP (1-4)	-	-	-	1.71 (.59)	1.72 (.60)	1.73 (.62)
2 SRinter (1-4)	<i>-.21</i>	<i>-.07</i>	<i>-.01</i>	1.95 (.67)	1.82 (.59)	1.77 (.61)
Article III, Study 1 ($N = 268$)						
Variable (Scale)	1	2	3	$M (SD)$		
1 SP (1-7)	-			3.89 (1.29)		
2 SRinter (1-7)	<i>-.02</i>	-		3.06 (1.08)		
3 SRintra (NS) (1-7)	<i>-.38</i>	.21	-	4.25 (1.19)		
4 SRintra (PE) (1-7)	<i>-.21</i>	.31	.31	4.62 (1.40)		
Article III, Study 2 ($N_F = 140; N_S = 124; N_E = 141; N_M = 81$)						
Variable (Scale)	1	2	$M_F (SD_F)$	$M_S (SD_S)$	$M_E (SD_E)$	$M_M (SD_M)$
1 SP (1-7)	-		3.60 (1.30)	3.45 (1.27)	3.50 (1.29)	3.64 (1.35)
2 SRinter (1-7) ^a	.06 - .11	-	2.74 (0.98)	2.76 (1.05)	2.77 (1.04)	2.58 (1.01)
3 SRintra (1-7) ^a	<i>-.34 - -.47</i>	.29 - .35	4.45 (1.11)	4.52 (1.13)	4.47 (1.10)	4.34 (1.02)
<p>Note. Correlations significant at $p < .05$ are given in italics. S1, S2 = Study 1, Study 2. SP = Punishment sensitivity; SRinter = Interindividual reward sensitivity; SRintra = Intraindividual reward sensitivity; NS = Novelty-seeking; PE = Positive expressiveness. t1, t2, t3 = 1st, 2nd, 3rd measurement points. F = Finnish; S = Swedish; E = English; M = Mathematics. ^a Given as a range due to slight variance in estimates arising from differences in course-specific samples.</p>						

3.1. Article I

Rawlings, A. M., Tapola, A., & Niemivirta, M. (2017). Predictive effects of temperament on motivation. *International Journal of Educational Psychology*, 6(2), 148-182. doi: 10.17583/ijep.2017.2414

In Article I, the dimensionality of temperamental sensitivities, particularly reward sensitivity, as well as their predictive effects on achievement goal orientations were examined. The article comprised two studies. The factor structure uncovered in Study 1 among a sample of general upper-secondary students ($N = 157$, aged 16–17 years, girls 57 %) was replicated in Study 2 among university students in humanities, social sciences, and education ($N = 506$; $M_{age} = 25.07$, $SD = 5.47$; women 86 %)¹, and the university students' achievement goal orientations were predicted from the extracted temperament dimensions.

In both studies, participants' temperamental sensitivities were measured using an instrument compiled from previous research, covering *punishment sensitivity* and two main reward sensitivity dimensions reflecting differences in sources of reward: *interindividual* (reward derived from others' praise and/or attention) and *intraindividual* (reward derived from one's own actions, inner states, responses to novelty). In Study 2, achievement goal orientations were measured with an instrument (Niemivirta, 2002) used in a growing body of previous research (for review, see Niemivirta et al., 2019). The measure taps five orientations: *mastery-intrinsic*, *mastery-extrinsic*, *performance-approach*, *performance-avoidance*, and *work-avoidance orientation*².

In both studies, the data were analysed with Exploratory Structural Equation Modeling (ESEM) with Geomin rotation, using Mplus statistics software (Muthén & Muthén, 1998–2015). This methodological choice was seen as appropriate for an exploratory examination of complex interconnected phenomena, as it allowed possible theoretically meaningful cross-loadings of items measuring temperamental sensitivities, rather than artificially suppressing them (Marsh et al., 2014).

In Study 1, after running the initial ESEM, item analyses were conducted and some changes made to the factorial structure, before running further ESEM analyses. The factor structure of the expected three-factor model (punishment sensitivity, interindividual reward sensitivity, intraindividual reward

¹ The distribution of gender is fairly representative of the population of university students in these fields (Official Statistics Finland, 2018).

² In Article I, this was referred to as avoidance orientation; however, for the sake of clarity, the term work-avoidance orientation was adopted in Article II. For coherence, this term is used throughout this Overview.

sensitivity) was found to be somewhat unclear, with two reward sensitivity items failing to load significantly on any factor. Testing a four-factor model resulted in a meaningful factor structure, with the intraindividual dimension further separating into two sub-dimensions: 1) enjoyment and seeking of novelty (labelled *intraindividual reward sensitivity – novelty-seeking*) and 2) a tendency for excitement and open expression of positive emotions about personal successes (labelled *intraindividual reward sensitivity – positive expressiveness*).

In Study 2, the achievement goal orientation items were specified as confirmatory factors, due to their distinct factorial structure validated in previous studies (for review, see, Niemivirta et al., 2019). A model was specified with the four temperament factors derived from Study 1 predicting the five achievement goal orientations. To establish the independent effect of each temperament dimension on each achievement goal orientation while controlling for the effects of the other dimensions, all achievement goal orientation variables were regressed on all temperament variables without fixed specifications of relationships.

The factor structure extracted in Study 1 was replicated with a different sample in Study 2, with the separation of the reward sensitivity factors implying that the measure validated in the study is sensitive enough to capture different dimensions of reward. The extracted dimensions were theoretically meaningful and, for the main part, in line with expectations, as were their differential effects on achievement goal orientations. The key predictions of the study were sensitivity to punishment being associated with performance concerns, novelty-seeking with enjoyment of learning, and seeking or needing social acceptance and praise being related to performance-approach, performance-avoidance, and work-avoidance orientations. The findings support the assumption of a link between temperament and motivation, and further, suggest that sensitivity to qualitatively different kinds of reward may guide motivation in different ways. Sensitivity to interindividual reward forming a distinct and robust dimension, with predictions on motivational orientations that differ from those of other reward sensitivity dimensions, appears a particularly salient discovery, as the effects of this type of reward have rarely been studied in relation to motivation, in spite of the social nature of the classroom context (e.g., Barrera & Schuster, 2018; Shin & Ryan, 2014).

3.2. Article II

Rawlings, A.M., Tapola, A., & Niemivirta, M. (2020). Longitudinal predictions between temperament and motivation in the early school years. *European Journal of Psychology of Education* 35(2), 451-475. doi: 10.1007/s10212-019-00432-w

Drawing on the results of Article I, the focus in Article II was to examine the stability and reciprocal relationships between punishment sensitivity and interindividual reward sensitivity (i.e., the temperamental sensitivities seen as academically potentially maladaptive) and achievement goal orientations, over the first three school years ($N = 212$; age 7–8 years at first measurement point; girls 52.8 %). Class teachers ($N = 25$) evaluated their students' temperamental sensitivities and achievement goal orientations in the spring term of each year of data collection using an online questionnaire.

Sensitivity to punishment (SP) and *interindividual reward sensitivity* (SR) were measured using relevant scales of the instrument validated in Study I, with slight modifications made to enable observer- rather than self-rating. Four dimensions of achievement goal orientations, namely, *mastery*, *performance-approach*, *performance-avoidance*, and *work-avoidance*, were measured using a likewise modified, observer-rated version of the instrument (Niemivirta, 2002) used in Study I.

The data were analysed using Partial Least Squares structural equation modeling (PLS-SEM), with the “plspm” package (Sanchez et al., 2015) with R software version 3.2.3, and imputing missing values using the “missForest” package (Stekhoven, 2013). For the measurement model, items were specified to load on their respective latent factors at each of the three measurement points. In the structural model, each construct at the third measurement point (t3) was regressed on each construct at the second measurement point (t2), and each construct at t2 on each construct at the first measurement point (t1).

Both temperamental sensitivities and all achievement goal orientations exhibited rank-order stability. A number of asymmetrically reciprocal chains of predictions were observed: first, SR at t1 negatively predicted change in mastery orientation at t2, which, in turn, negatively predicted change in SR at t3. Second, a similar, but positive, chain of asymmetrically reciprocal effects was observed between performance-approach orientation and SR. Third, SR at t1 positively predicted change in performance-avoidance at t2, and SR and performance-avoidance both positively

predicted change in each other at t3. Fourth, a similar chain of predictions was observed between work-avoidance and mastery orientations, so that work-avoidance orientation at t1 negatively predicted change in mastery orientation at t2, and both orientations negatively predicted change in each other at t3.

In addition to the reciprocal effects, SP at t2 negatively predicted change in SR at t3, and positively in performance-avoidance orientation. Work-avoidance orientation at t2 positively predicted change in SR at t3. Finally, some indirect effects were also observed. SP and performance-approach orientation at t1 negatively predicted change in each other at t3, although no direct effects were observed between them. Mastery and work-avoidance orientations at t1 negatively predicted change in each other at t3. Change in SR at t3 was negatively predicted by SP and positively by work-avoidance orientation at t1, and change in performance-avoidance at t3 positively by both SP and SR in at t1.

By these results, young students' temperamental sensitivities and achievement goal orientations are quite consistently linked already in the first school years, and their stability and early linkages appear educationally important. Of particular note is interindividual reward sensitivity being associated with a decrease in mastery-oriented strivings, on the one hand, and an increase in the performance-avoidance and performance-approach orientations, on the other. Mastery orientation is associated with phenomena that are beneficial both academically and from the point of view of individual well-being (e.g., high school engagement, low cynicism and emotional cost; Tuominen et al., 2020), whereas performance-avoidance orientation is linked with, for example, cynicism and experiences of inadequacy (Tuominen-Soini et al., 2012). Further, performance-approach orientation has been found connected with potential problems within the social environment (e.g., perceiving and treating others as adversaries; Poortvliet & Darnon, 2010). The observed links may, therefore, have long-lasting significance with regard to students' learning, school experiences, and overall well-being, with students prone to interindividual reward sensitivity potentially rendered in a disadvantaged position both educationally and socially, even from the first school years onwards.

3.3. Article III

Rawlings, A.M., Tapola, A., & Niemivirta, M. (2021). Temperamental sensitivities differentially linked with interest, strain, and effort appraisals. *Frontiers in Psychology, 11*:551806. doi: 10.3389/fpsyg.2020.551806

In Article III, links between temperamental reward and punishment sensitivities and students' motivational appraisals (interest, strain, and effort) were examined in two studies. Study 1 was conducted within the domain of mathematics in a cross-sectional design among eighth-grade students ($N = 268$, $M_{age} = 14.34$; girls 49.6 %). In Study 2, a course-specific approach was adopted, and the relationships were studied with repeated measures in four key school subjects among general upper-secondary students ($N = 155$, age 16–17, girls 56.1 %)³. The effect of previous achievement in the subject was controlled in both studies, and in Study 2, subject interest was added as a predictor of the motivational appraisals, and students' satisfaction in their course performance as an outcome variable.

Data for Study 1 were collected during the spring term, with the students responding to the temperamental sensitivity questionnaire validated in Article I, and also rating their mathematics-related interest, strain, and effort. Some weeks later, the students took a low-stakes mathematics test during a mathematics class, and their performance in this task was used as an indicator of their mathematical ability. ESEM analyses gave a four-factor structure for temperament corresponding to the one in Article I. Sensitivity to punishment was positively predictive of mathematics strain, which, in turn, was negatively predictive of task performance. Intraindividual reward sensitivity for novelty-seeking was positively predictive of mathematics interest and effort. Previous achievement was positively linked with mathematics interest, effort, and task performance, and negatively with mathematics strain.

In Study 2, the students rated their temperamental sensitivities and their interest in all school subjects at the beginning of the school year. Two course-specific data collection points were established for each course examined, so that in the early part of the first course (t1) in Finnish, Swedish, English, and advanced syllabus level mathematics, and after the

³ Note that while the sample is the same as in Study 1 of Article I, the data used in Study 2 of Article III are from a measurement taken in the beginning rather than the end of the school year, and were thus previously unpublished.

final exam at the end of the course (t2), the students rated their interest, their experiences of psychological strain, and their effort expenditure regarding each given course. Finally, to capture a subjective experience of success, the students were asked whether they were satisfied with their course performance after they had received their course grades.

PLS-SEM was used to analyse the data. A measurement model with the four-factor structure of temperament was initially tested. Three items were removed via an iterative process due to insignificant loadings, low AVE, and/or poor communality. As some novelty-seeking and positive expressiveness items were then found to cross-load strongly, a parsimonious model with SP and two reward sensitivity dimensions, interindividual (SRinter) and intraindividual (SRintra), was tested and found to describe the data well, with the model displaying adequate internal consistency and convergent and discriminant validity. A structural model was specified, with course satisfaction regressed on course grade, and both on all other variables; t2 motivational appraisals on t1 motivational appraisals and the hypothesised antecedent variables; and t1 motivational appraisals on the hypothesised antecedents.

SRinter predicted strain at t1 in Swedish and in English, and had a small negative effect on effort at t1 in mathematics. SRintra was a positive predictor of interest and effort at t1 in Swedish, and of effort at t1 in mathematics. It also had small effects on effort at t1 and increased interest at t2 in Finnish.

In all subjects, subject interest predicted interest at t1 positively and strain at t1 negatively. Subject interest also predicted effort at t1 in Finnish, increased interest at t2 in Swedish, and decreased strain at t2 in English. Previous achievement was a negative predictor of strain at t1 in all subjects apart from Finnish.

All motivational appraisals showed significant stability over the duration of the course in all subjects, but remained fairly independent of each other. Interest at t1 predicted decreased strain at t2 in mathematics. Effort at t1 predicted increased interest at t2 in Swedish, and had a small effect on increased interest at t2 in mathematics. In English, effort at t1 predicted increased strain at t2, and there was also a small reciprocal effect from strain at t1 on increased effort at t2.

In all subjects, previous achievement predicted the course grade, which, in turn, predicted course satisfaction. The course grade was also negatively predicted by SRintra in English and by strain at t2 in English and in mathematics, as well as positively by effort at t2 in mathematics. Regarding

course satisfaction, it was also predicted negatively by interest at t1 in Swedish. In Finnish, strain at t1 predicted course satisfaction positively, but strain at t2 negatively. Finally, in mathematics, strain at t1 predicted course satisfaction negatively.

The results of the two studies reinforce the understanding gained from Articles I and II of temperamental sensitivities, including sensitivity to qualitatively different kinds of rewards, being differentially related to motivation in a learning context. Reflecting previous findings and in line with expectations, punishment sensitivity and interindividual reward sensitivity appeared motivationally maladaptive, as they were positively linked with strain and negatively with effort, whereas intraindividual reward sensitivity seemed mostly beneficial, with positive predictions on interest and effort. The findings also highlight the positive role of subject interest in supporting course interest and, together with previous achievement, buffering against strain.

4. GENERAL DISCUSSION

The aim of this thesis was to increase understanding of the connections between temperament and motivation in a learning context. Temperament was viewed as sensitivity to reward and punishment (e.g., Corr et al., 2013; Hundt et al., 2013; Rothbart & Hwang, 2005), with the assumption that differences in these sensitivities would be reflected in different motivational outcomes. Furthermore, while temperament research distinguishes and indeed recommends considering reward sensitivity as comprising different dimensions (Corr, 2016; Corr & Cooper, 2016; Krupić, Corr, et al., 2016) due to the complex nature of the approach tendency (Corr & Cooper, 2016), this multidimensionality has been a somewhat neglected aspect in previous research examining the relationships between temperament and motivation. Therefore, it was seen as important to take a more differentiated view of reward sensitivity. Based on an examination of previous operationalisations (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Rothbart, 2007; Torrubia et al., 2001), reward sources were categorised as interindividual, in other words, as dependent on the (perceived) actions and responses of other people, and as intraindividual, that is, stemming from an individual's own actions and inner states. An instrument compiled from items used in previous research was validated and taken into use, with the intention of examining inter- and intraindividual reward experiences that would be salient as well as typically encountered in a learning situation, regardless of the age or academic stage of the participating student.

Motivation, in turn, was approached through achievement goal orientations and appraisals of interest, strain, and effort. Assuming connections between these central motivational concepts and individuals' temperamental sensitivities appeared plausible and conceptually justifiable. Achievement goal orientations, describing individuals' preferred outcomes in learning contexts (Niemivirta, 2002), are in part defined by characteristic responses to the learning environment, such as focusing on the task or on success relative to others (Nicholls, 1984), or approaching or avoiding achievement situations (Elliot & Covington, 2001). In turn, the environmental cues an individual focuses on as well as approach/avoidance tendencies are considered as being guided by temperamental sensitivities (Corr et al., 2013; Rothbart, 2007; Rothbart & Hwang, 2005). Likewise, assuming links between temperamental sensitivities and the proneness to

evaluate and respond to (i.e., appraise) situations or contexts in a given way was supported by theory (e.g., Lazarus & Smith, 1988) and previous findings (e.g., responsiveness to novelty arousing interest; Hidi, 2016; Silvia, 2017; punishment sensitivity increasing stress proneness; Heponiemi et al., 2003; reward responsiveness being related to higher well-being; Taubitz et al., 2015).

The main assumption of the thesis was that temperamental sensitivities guide motivation in different ways. Taken as a whole, the results of the articles included in the thesis support this assumption, both when viewing motivation as achievement goal orientations in a general learning context, and as motivational appraisals in a domain setting as well as in relation to specific courses in different subjects. In the three articles, a pattern emerged, showing punishment sensitivity and interindividual reward sensitivity to be quite consistently maladaptive motivationally, whereas intraindividual reward sensitivity appeared mostly to support motivation. In general terms, this was as expected, although some individual relationships or indeed lack of them went against the initial assumptions.

In the following, I will discuss in more detail the findings of the research presented in this thesis, in relation to the main research questions outlined in Chapter 2.1, namely, 1) regarding the dimensionality of temperamental sensitivities; and 2) the linkages between these dimensions and motivation in a learning context, when motivation is viewed as (i) achievement goal orientations and as (ii) motivational appraisals of interest, strain, and effort.

4.1. Main findings

4.1.1. Dimensionality of temperamental sensitivities

In Article I, the reasoning for compiling an instrument covering reward sources seen as relevant in a learning context, as well as item choice, were described in detail, and the factorial structure of the instrument was tested with two data sets (Study 1, first-year general upper-secondary students at the end of the school year; Study 2, university students) using ESEM. Based on analyses of items chosen from previous instruments (Carver & White, 1994; Cloninger et al., 1993; Colder & O'Connor, 2004; Rothbart, 2007; Torrubia et al., 2001), an assumption of a three-dimensional factor structure was made, comprising punishment sensitivity, interindividual reward sensitivity (reward derived from others' actions and attitudes, such as attention or praise), and intraindividual reward sensitivity (reward derived

from novel experiences, one's own actions and mental states). The empirically observed factor structure corresponded, in part, to this expectation, but with the added distinction of intraindividual reward sensitivity being observed to form two sub-dimensions. These sub-dimensions describe enjoyment and seeking of novelty (labelled novelty-seeking) and a tendency for positive emotionality, expressiveness, and enthusiasm, especially with regard to one's own successes (labelled positive expressiveness). To some extent, these sub-dimensions of intraindividual reward sensitivity could be seen as resembling the BAS-reward interest and BAS-reward reactivity dimensions described by Corr and Cooper (2016), in that novelty-seeking reflects the future-orientation (Satchell et al., 2017) or anticipatory pleasure (Gomez et al., 2020) defining the reward interest dimension, and positive expressiveness is akin to the pleasure of attained or immediate rewards described by reward reactivity (Gomez et al., 2020; Satchell et al., 2017).

In further analyses in Study 2 of Article I, all four temperament dimensions were found to be meaningfully and differentially connected with achievement goal orientations. The same dimensions were discovered also in Study 1 of Article III, and their relationships with domain-specific interest, strain, and effort were distinct from each other. However, when a different analytical method (PLS-SEM) was applied in Study 2 of Article III, a model corresponding to the initial expectation of a two-dimensional reward sensitivity (i.e., inter- and intraindividual reward dimensions, without the novelty-seeking/positive expressiveness separation) was found to describe the data better, with the two reward dimensions exerting theoretically meaningful effects on course-specific motivation.

Possible reasons for the observed difference in factorial structure between the studies will require further examination in future research. It is possible that this is a function of the inherently somewhat different aims of the analytical methods applied (reproduction of covariance matrix in the SEM framework vs. maximising explained variance in PLS; Sarstedt et al., 2017). Future research should consider using different methodological approaches to analyse the same data set, so as to examine potential differences brought about by methodological choices. Moreover, it is crucial to continue to study the development and distinction of temperamental sensitivities over time and among different age groups.

Interrelationships of the temperament dimensions

A full comparison of the respective interrelationships between the dimensions of temperamental sensitivities is made somewhat difficult due to the respective differences in factorial structures between some of the studies discussed above. Further, Article II focused on punishment sensitivity and interindividual reward sensitivity only. It is also worth noting that interindividual reward sensitivity has not often been examined as a separate dimension, making it difficult to compare the interrelationships observed between interindividual reward sensitivity and the other temperamental sensitivities examined here with findings from previous research.

That said, based on the results of Articles I and III, punishment sensitivity appears negatively related to intraindividual reward sensitivity. This is unsurprising, given that punishment sensitivity is characterised by an aversion to novelty (e.g., Rothbart et al., 2001; Rothbart & Jones, 1998), which, conversely, is a central source of intraindividual reward (see, e.g., Corr & Cooper, 2016; Gomez et al., 2020; Satchell et al., 2017). The withdrawal tendency associated with punishment sensitivity may also go against the open expression of positive emotionality and enthusiasm over one's successes, described by the separate, positive expressiveness sub-dimension in Article I and Study 1 of Article III, and included within intraindividual reward sensitivity in Study 2 of Article III. It should, however, be noted that the correlation between punishment sensitivity and the positive expressiveness sub-dimension was non-significant in Study 1 of Article I, and their negative correlation in Study 2 of Article I was weaker than the correlation between punishment sensitivity and novelty-seeking. These connections reflect, to some extent, the findings of Corr and Cooper (2016), who observed a modest positive correlation between reward reactivity (resembling positive expressiveness) and the FFFS and BIS (resembling punishment sensitivity). It may be that high punishment sensitivity does not necessarily preclude *experiencing* positive emotionality and enthusiasm over one's successes, but may thwart or reduce its open *expression*, an aspect that is central in the operationalisation of the positive-expressiveness sub-dimension. Refined operationalisation might be needed, in order to examine the experience separately from its expression, and achieve increased understanding.

The relationship between punishment sensitivity and interindividual reward sensitivity was not entirely straightforward. In Articles I and III, the two sensitivities were correlated positively or non-significantly, and the

punishment sensitivity item “*I get upset easily if I am criticised or told off*” positively cross-loaded onto interindividual reward sensitivity. This bears interesting similarity to the correlations and even cross-loadings observed by Colder et al. (2011) between the fear/shyness and anxiety dimensions on the one hand, and the “responsiveness to social approval” reward dimension, on the other. Further, also Cloninger and colleagues’ (1993) reward dependence dimension (depicting sensitivity to social approval) has been observed to have positive connections with behavioural inhibition, rather than with behavioural approach (Mardaga & Hansenne, 2007; Vandeweghe et al., 2016). These relationships suggest that heightened sensitivity to negative social evaluation characterises both punishment sensitivity and interindividual reward sensitivity.

However, in Article II, punishment sensitivity and interindividual reward sensitivity were found to correlate negatively within the first measurement point, and punishment sensitivity predicted interindividual reward sensitivity negatively between the latter two measurement points. This may, at least to some extent, be due to a method effect; instead of the self-evaluations utilised in Articles I and III, teacher-ratings were used in Article II, and some sensitivities as well as their interrelationships may be challenging for an observer relying on an examination of behavioural responses to detect and judge accurately (see, Funder & Dobroth, 1987). Also notably, the teacher-rated scale lacked an item corresponding to the aforementioned item from the self-evaluation scale, describing reactions to negative social evaluations (i.e., “*I get upset easily if I am criticised or told off*”). It may be that this aspect in particular is the characteristic shared by these two otherwise apparently fairly dissimilar sensitivities. However, it should also be noted that in Article II, their initially significant, negative within-measurement-point correlation became non-significant within the latter two measurement points. It may, hence, be that the valence of their interrelationship is also related to the age and developmental stage of the participants – in other words, that a sensitivity to social “punishments” as well as rewards (see, Mardaga & Hansenne, 2007) may develop with maturation. Examining these connections and their development over time is necessary in future research.

The relationships between all reward sensitivity dimensions were positive in both studies of Article III. In Article I, interindividual reward sensitivity correlated non-significantly with novelty-seeking in both studies, and with positive-expressiveness in Study 1.

In sum, the hypothesised separation of inter- and intraindividual reward sensitivities was supported by the findings, and the instrument validated and taken into use in the research presented in this thesis appears satisfactory for measuring these dimensions. In the studies in which both inter- and intraindividual reward sensitivities were examined, these main dimensions of reward sensitivity could be differentiated among different age groups (early adolescents in comprehensive school, Study 1 of Article III; students starting their upper-secondary education, Study 1 of Article I, Study 2 of Article III; adult students at university, Study 2 of Article I). In all three articles, the measured dimensions of temperament had theoretically meaningful, differential connections with motivation.

4.1.2. Temperament and motivation

In the following, I will outline and discuss the main findings regarding the relationship between temperament and motivation. In addition to these, the research yielded also other information, for example, regarding the interrelationships of achievement goal orientations in the early school years (Article II) and of motivational appraisals in upper-secondary school (Article III, Study 2), as well as the impact of individual interest and previous achievement on motivational appraisals and effects of temperament and motivation on academic achievement (Article III). These results are relevant and often interesting; however, as exploring the effects of temperament on motivation was the main aim and reason for conducting this research, I shall limit my discussion on summarising and considering these findings.

Temperament and achievement goal orientations

The relationships between temperamental sensitivities and achievement goal orientations were examined among first-year university students (Study 2 of Article I) and over the course of the three first years of comprehensive school (Article II). There were some design differences between the two articles, in that Article II focused on punishment sensitivity and interindividual reward sensitivity only. Furthermore, while a differentiation between mastery-intrinsic and mastery-extrinsic orientations (Niemivirta, 2002) was included in Article I, mastery orientation was considered as a unidimensional construct in Article II, due to the young age of the participants and the fact that external, formal criteria of learning (namely, grades) central to the mastery-extrinsic orientation are rarely, if ever, used during these first school years within the Finnish educational system. Taking into account these design differences between the two articles, there was even

remarkable similarity in their respective results, especially considering the age gap between the students participating in them.

In both studies, interindividual reward sensitivity had negative links with mastery (in Article I, mastery-intrinsic) orientation, and positive links with both performance-approach and performance-avoidance orientations, as well as the work-avoidance orientation. Being negatively connected with mastery and positively with both of the two performance orientations suggest that in an environment where academic achievement is valued (or perceived as valued), heightened need for praise and/or attention from others may divert students' focus from the enjoyment of learning, and instead induce a concern over one's performance relative to others (see, e.g., Jagacinski & Nicholls, 1984; Nicholls et al., 1989). By these results, such performance concerns may manifest as a tendency to view academic achievement as a way of gaining social approval and/or attention, to compare one's academic achievement with that of others, and to compete with others (as is the case in performance-approach orientation). However, it appears it may also work "in negation", as it were: for a student high in interindividual reward sensitivity, the possibility of failing to achieve as well as others in a competitive academic environment (or one perceived as such) may represent a threat of losing social approval, and/or of being (publicly) negatively evaluated. Then, instead of competing and attempting to outperform others, such a student may prefer to withdraw from potential competition (as in performance-avoidance orientation). Whether a student adopts the performance-approach or performance-avoidance orientation may depend on a number of factors, such as the relative emphasis of other temperamental sensitivities, or other goals they may endorse (see, e.g., Pintrich, 2000).

As to the connections between interindividual reward sensitivity and work-avoidance orientation, work-avoidant students' interests are assumed to lie not in academic, but other areas of life (Archer, 1994; Nicholls, 1989). Further, it has been suggested that the alienation and experienced meaninglessness associated with work avoidance imply a perceived discord between the performance expected of an individual, and the reward gleaned from the performance (Jagacinski et al., 2020). It should be noted that social support from teachers (e.g., students experiencing their teachers as caring about how well they do) and peers (i.e., students' friends valuing school and education) has been found to buffer against work-avoidance goals in adolescence (King & McInerney, 2014). Perhaps students with a particular sensitivity to reward derived from others' actions and attitudes are also

sensitive to perceive and react to a *lack* of such social support and the potential reward it might provide, and these experiences may, then, render them susceptible to adopting work-avoidance goals. For now, these considerations must remain speculative, as students' experiences of social support were not examined in this dissertation. However, including such factors might be an important addition to future research on these relationships.

In both articles, performance-avoidance orientation was linked also with punishment sensitivity. This was expected, given punishment sensitivity is virtually by definition associated with avoidance or withdrawal tendencies, and an aversion to novelty (e.g., Cloninger et al., 1993; Rothbart et al., 2001; Rothbart & Jones, 1998). Furthermore, among the university-student participants of Article I, punishment sensitivity was also positively connected with mastery-extrinsic orientation as well as performance-approach orientation, rather against expectations. These latter two orientations are both related to the goal of achieving at a high level, although separated by the respective criteria for judging successful attainment of this goal: absolute (e.g., top grades) in mastery-extrinsic orientation, but relative (i.e., achieving at a higher level than others) in performance-approach orientation (Niemi-virta, 2002). While the expected effect on performance-avoidance orientation was considerably stronger, the other two relationships are, regardless, interesting and may be indicative of the "approach-to-avoid" effect (i.e., a student fearing failure strives to avoid it by approaching success; Elliot & Thrash, 2001) observed previously in connection with punishment sensitivity or related constructs among both pre-adolescents (Bjørnebekk & Diseth, 2010) and university students (Elliot & Thrash, 2002).

With regard to the developmental interconnections between temperament and motivational orientations observed among the younger students of Article II, it should be noted that the obtained results are, as it were, filtered through teachers' ratings. This may, for example, go some ways towards explaining the fact that while punishment sensitivity was, as expected, linked with performance-avoidance orientation, this sensitivity was nevertheless less connected with the achievement goal orientations than expected. Some personality traits are considered as inherently less "visible" to external observers than others (Kenny & West, 2010), and particularly characteristics resembling punishment sensitivity, such as discomfort with uncertainty and complexity or concern over one's adequacy, have been found difficult to detect accurately in others (Funder &

Dobroth, 1987). Furthermore, while goal adoption cannot sensibly be claimed to influence temperamental sensitivities, the two are linked in teachers' perceptions of their students. To illustrate, a student seen as high in the need to outdo others academically (i.e., performance-approach orientation) in the first grade was more likely to be evaluated by the teacher as sensitive to attention and praise from others (i.e., interindividual reward sensitivity) in the second grade.

As to the relationships between the intraindividual reward dimension and achievement goal orientations (Study 2 of Article I), assumptions of motivationally beneficial effects were mostly supported by the results. The novelty-seeking dimension of intraindividual reward sensitivity predicted mastery-intrinsic orientation among university students positively and work-avoidance orientation negatively. However, while novelty-seeking was also associated positively with performance-approach orientation, the positive-expressiveness dimension was negatively related to both performance-approach and performance-avoidance orientations. The positive linkage with endorsing mastery and performance goals is in line with previous research (e.g., Bjørnebekk & Diseth, 2010; Elliot & Thrash, 2002, 2010). The negative prediction on performance orientations by positive expressiveness, hence, is interesting and warrants further examination in future research.

Temperament and motivational appraisals

In Article III, the aim was to broaden understanding of the connections between temperament and motivation by examining the relationships between temperamental sensitivities and motivational appraisals of interest, strain, and effort, in two studies. Study 1 was conducted in the context of a domain (mathematics) among eighth-graders, and Study 2 course-specifically in four different subjects among upper-secondary students, with the motivational appraisals measured at the beginning and at the end of the course. The effects of both temperament and motivation on achievement (mathematics task in Study 1, course grades in Study 2) were also inspected. While there were some differences in the relationships both between the two studies and between the four examined courses, similarities were also observed, and the results were mostly in line with expectations. Overall, intraindividual reward sensitivity appeared motivationally more supportive than punishment sensitivity and interindividual reward sensitivity, reflecting the findings of Articles I and II.

Interest and effort were quite similarly related with temperament in both the domain setting of Study 1 as well as the course context of Study 2, as intraindividual reward sensitivity was found to be linked with both appraisals in both studies – furthermore, these connections with interest and/or effort were observed in three out of the four subjects examined in Study 2. The motivationally adaptive quality of intraindividual reward sensitivity, hence, appears to be rather robust and fairly independent of context. This makes sense, in that the dimension is intended to capture sensitivity to reward derived from one’s own actions and inner states (Carver & White, 1994; Cloninger et al., 1993; Colder & O’Connor, 2004; Rothbart, 2007), which is perhaps less likely to be influenced by environmental or situational factors. Further, this result is in keeping the findings of Article I, in which this sensitivity was linked with mastery-oriented goal strivings, which are, in turn, associated with interest (Tapola et al., 2013) and effort (Hornstra et al., 2017), and supports the more general assumption that interest may be more readily aroused in individuals given to approach tendencies and responsiveness to novelty (Hidi, 2016; Hidi & Renninger, 2006; Silvia, 2017).

Regarding strain, the findings of the two studies differed in an interesting way. In Study 1, strain was related to punishment sensitivity, as assumed, but against expectations and the indications derived from Articles I and II, interindividual reward sensitivity was unconnected with strain and indeed all motivational appraisals. However, in Study 2, conversely, strain was predicted by interindividual reward sensitivity in two of the four subjects examined, and their correlation was consistently positive, whereas punishment sensitivity remained quite separate from all other variables.

Punishment sensitivity has previously been linked with stress (Williams et al., 2014; see also, Ravaja et al., 2006) and negative affect (Bjørnebekk, 2007). Hence, the positive prediction on strain in Study 1 was expected as well as meaningful, whereas the lack of connections in Study 2 was surprising and not easy to interpret. While it is naturally encouraging to find that the aversion to novelty and fear of public embarrassment that are associated with punishment sensitivity (Colder et al., 2011; Colder & O’Connor, 2004; Derryberry et al., 2003; Rothbart & Hwang, 2005; Torrubia et al., 2001) do not, according to the present results, necessarily contribute to increased stress levels, the possibility that the contexts of the two studies may have had an impact on the results should be considered. It may be that the relationship between punishment sensitivity and strain is less straightforward or less easy to observe in the course context of Study 2, in

which situational factors – known to affect students’ motivational appraisals (see, e.g., Rauthmann et al., 2016) – quite likely were more pronounced than in the domain context of Study 1. Another contributing factor might have been the focus on aversion to new situations or people in the operationalisation of punishment sensitivity, which may more accurately describe the experiences of the somewhat younger students of Study 1. Participants of Study 2 were starting their tenth year of formal education; at this stage of their academic careers, they may already be quite acquainted with situations they encounter, and may have developed productive coping strategies (P. Evans et al., 2018) or high self-regulation (Scrimin et al., 2018), both of which have been found to compensate, to some extent, for the effects of punishment sensitivity. That said, this was also these students’ first year after a major academic transition, and it is likely they would also experience and/or anticipate novel situations, challenges, and demands, which could be expected to induce anxiety or worry, and activate punishment sensitivity. Further longitudinal study amongst students of different ages, over a longer period of time (e.g., entire school year) as well as on a micro level (e.g., using the Experience-Sampling Method; Csikszentmihalyi & Larson, 2014), might enable increased understanding of the relationships, which now remain somewhat speculative.

As to strain, contextual and developmental differences may go some ways towards explaining the differences in the connections it was found to have with interindividual reward sensitivity – and indeed, lack thereof. While interindividual reward sensitivity has been rather little researched, the results from Articles I and II (i.e., connections with higher work avoidance, concerns over one’s performance relative to others, lower mastery strivings) suggest that proneness to this sensitivity may guide students to emphasise gaining and maintaining social approval instead of, or through, schoolwork and learning. In such a case, it might be of importance whether schoolwork and learning – in general, or indeed in mathematics, the domain examined in Study 1, in particular – are valued in one’s social environment. It may be that students at the comprehensive-school stage of Study 1 do not perceive schoolwork and/or successful performance in mathematics as something that has an impact on their social relations and standing, be it positively or negatively – in other words, if nothing is at stake, the students are likely to appraise it as being irrelevant (Lazarus & Folkman, 1984). Conversely, academic ability and achievement may be quite highly valued within the social environment of the general upper-secondary context of Study 2, and therefore, for these older students,

success at school might be perceived as important for gaining others' praise and attention, and hence interindividual reward sensitivity would be a more important contributing factor to their motivational appraisals, experiences, and responses, including rendering them more vulnerable to increased stress and experienced difficulty.

4.1.3. Findings summarised

Overall, the findings indicate that temperamental reward and punishment sensitivities are associated with students' motivation, as regards both goal adoption and motivational appraisals, and support considering reward sensitivity as dimensional, as the different dimensions were consistently and meaningfully differentially related to motivation. Intraindividual reward sensitivity was found to be motivationally supportive, with links with mastery motivation, interest appraisals, and willingness to exert effort. In contrast, interindividual reward sensitivity was found associated with performance concerns and work avoidance, as well as higher strain, and hence appears maladaptive as regards motivation and well-being. While punishment sensitivity was somewhat less related to motivation than expected, its influence was, regardless, also mainly problematic, with links to heightened performance concerns and strain experiences.

If we consider temperamental sensitivities as “*a set of constitutionally based individual-differences variables*” (Rothbart et al., 2001, p. 56), in other words, innate to some degree, we must also consider them as having an evolutionary base (see, e.g., Krupić, Gračanin, et al., 2016). It appears unlikely that any such inherent sensitivity would be, fully or only, “maladaptive” in and of itself. Therefore, what appears as a maladaptive impact on motivation or well-being in the present context of formal learning ought to be seen as a “mismatch” between the function of the sensitivity and (aspects of) this context. While any detailed examination of the evolutionary bases of temperamental sensitivities is quite beyond the scope of this thesis, this aspect should, ultimately, be kept in mind when interpreting the meaning of the present findings. As fundamentally changing innate or very deeply rooted characteristics, maladaptive or adaptive, is unlikely to be successful, education should, instead, ensure it supports individuals in finding ways of adapting to environmental demands and coping with their particular sensitivities and needs. It follows that educational contexts and practices should be organised in such a way that they allow for the emergence of the adaptiveness that must also surely be inherent in each

sensitivity; a failure to do so risks rendering some students prone to “*motivational inequality*” (Jagacinski & Nicholls, 1984, p. 918).

4.2. Theoretical implications

The present dissertation adds to current knowledge in a number of ways. The differentiated perspective on reward sensitivity, gained by considering the effects of qualitatively different rewards, may allow us to begin to identify potential antecedents of both adaptive and maladaptive motivational orientations and experiences with higher accuracy. Studying the connections among different age groups as well as with both self- and teacher-ratings, with consistent results, speaks for the validity of the findings, and the longitudinal design applied particularly in Article II enables some examination of developmental interrelationships. Although different reward dimensions have been recognised in temperament research, they have received relatively little attention in motivation research. I argue that the results of the present dissertation strongly suggest the validity and importance of taking a more differentiated view into reward sensitivity also in the realm of motivation.

Further, of particular note is the way interindividual reward sensitivity appears consistently connected with educationally more maladaptive motivational outcomes. Sensitivity to this kind of reward may guide students’ focus on gaining and maintaining social approval over schoolwork and learning, or possibly, influence seeing learning as a means for gaining these rewards, rather than an end in itself. This may render students vulnerable to increased stress and experienced difficulty of courses, regardless of level of ability.

As to intraindividual reward sensitivity, two issues should be noted. Overall, sensitivity to this type of reward appeared motivationally beneficial. However, its dimensionality requires further examination, as the subdimensions observed in Article I and Study 1 of Article III could not be extracted in Study 2 of Article III, possibly due to the different methodological approach applied in the latter study. Further, it perhaps deserves to be noted that the adaptive influence on motivation may be particularly due to the novelty-seeking aspect of this sensitivity. In the studies (Article I; Study 1 of Article III) in which intraindividual reward sensitivity comprised two sub-dimensions, the positive-expressive dimension had fewer connections with students’ goal orientations, only being negatively related to the performance goal orientations, and was

unconnected with the motivational appraisals. The “drive” to approaching a (potential) reward may, hence, be more due to the “future-oriented” novelty-seeking dimension, and the “now-oriented” positive-expressive dimension describing the tendency to delight in one’s achievements appears less predictive of students’ motivation (see, Satchell et al., 2017).

Finally, the linkages between punishment sensitivity and motivation were somewhat mixed and also fewer overall than initially assumed. Although it was, as expected, connected with performance-avoidance orientation among both university students (Article I) and during the early school years (Article II), among the older students, linkages with mastery-extrinsic and performance-approach orientations were also observed, lending support to the suggested “approach-to-avoid” tactic (Elliot & Thrash, 2001). In other words, as students temperamentally disposed to anxiety and avoidance tendencies progress through school, they may develop a way of dealing with these experiences and tendencies by approaching achievement situations rather than avoiding them, perhaps not as much, or merely, due to a desire to succeed, but rather in order to avoid the threat of failure and the detrimental effects it might have on their sense of self (see, Boekaerts & Niemivirta, 2000). One might expect that this kind of “going against” one’s inherent tendencies might increase stress experiences, and examining temperament, goal adoption, and motivational appraisals together might, therefore, be useful for examining these processes further.

4.3. Practical implications

The findings of the present dissertation also have practical applicability, in that they may be used to develop and foster teaching and assessment practices that support students with different temperamental and motivational tendencies. While not the topic of this dissertation, I will consider these possibilities briefly.

Overall, the results highlight the importance of taking into account individual differences in students’ sensitivities and needs in a learning environment. In particular, the links with educationally maladaptive outcomes identified in connection with punishment sensitivity (e.g., concerns over one’s performance relative to others, Articles I and II; higher stress and experienced difficulty, Study 1 of Article II) and sensitivity for attention and/or praise from others (e.g., lower mastery strivings, higher work-avoidance, focus on performance concerns, Articles I and II; higher stress and experienced difficulty, lower effort, Study 2 of Article III) should

be noted. These links suggests a need to plan and carry out learning activities and assessment in ways that do not trigger, for example, stress experiences and avoidance in students with high levels of such sensitivities.

For example, a practice of overt emphasis on evaluation and assessment tends to bring about a focus on (perceived or actual) between-student comparisons and ability demonstration (see, e.g, Butler, 2006). This might be particularly stressful for students for whom gaining and maintaining social approval is of heightened importance, as they may experience (potential) failure at being successful in a competitive environment as threatening the attainment of this essential reward, perhaps rendering these students vulnerable to worry over their very adequacy as individuals (see, e.g., Nicholls et al., 1989). Furthermore, students prone to inhibition have been found to have lower self-concept, in other words, to perceive themselves as less able, potentially due to comparing themselves with their less inhibited, more approach-oriented peers (Viljaranta et al., 2020). Reducing between-student comparisons, as well as the focus on assessment more generally, might be supportive for the motivation and well-being of these students. Overall, the findings echo the previously-identified need for *temperament-conscious education* (Mullola, 2012), as an increased understanding of temperamental tendencies may enhance educators' pedagogical sensitivity and support them in finding ways of responding to their students' individual characteristics and needs (see, e.g., Hirvonen, 2013).

4.4. Limitations and suggestions for future research

Naturally, the research presented in this thesis has some limitations. Although including participants of different ages and stages of academic careers as well as self- and teacher-ratings, with the validity of the findings being supported by their being largely in line with each other, the number of participants was quite small particularly in Study 2 of Article III, meaning one needs to exercise some caution in generalising the results. Further research with more participants, from different ethnic and socio-economic backgrounds and within different cultural settings, is needed. Also, the potential effects of gender were not considered in the present research. As there are indications of, for example, girls displaying higher levels of punishment sensitivity than boys (e.g., Heponiemi et al., 2003; Kingsbury et al., 2013; Mardaga & Hansenne, 2007), which may, in turn, be reflected in their motivational orientations and/or experiences, this factor should be taken into account in future research.

Article II utilised teacher-reports exclusively. Although this practice has support from previous research (e.g., Bishop et al., 2003; Hirvonen et al., 2013; Poropat, 2014), disparity has also been observed between teacher-, parent-, and self-ratings of some aspects of temperament (De Decker et al., 2017; Viljaranta et al., 2015) and achievement goal orientations (Dicke et al., 2012). While self-reports from very young children may be challenging to gather, utilising multiple informants would likely give increased understanding. Using different means of data collection, such as vignettes (e.g., Barter & Renold, 2000; Palaiologou, 2017), might prove useful with participants in the earliest school years. It should also be noted that only two dimensions of temperamental sensitivities – sensitivity to punishment and interindividual reward sensitivity – were included in the design of Article II. Future studies conducted within the early school years should include also intraindividual reward sensitivity, to enable forming a fuller picture of the early connections between temperament and motivation.

While Article II and Study 2 of Article III were conducted in a longitudinal framework, the time span covered in Study 2 of Article III was relatively short, amounting to some six weeks. More longitudinal research, covering longer periods of time (e.g., a whole school year, throughout upper-secondary school) at different ages and educational stages, is needed in order to examine in more detail the dynamics between temperamental sensitivities and motivation and its development. Also, the present thesis merely touched upon connections between temperament and situational motivation in the course setting of Article III, and more in-depth research into these connections, thus, remains a topic for further study. For example, classroom or teacher characteristics (Carmichael et al., 2017) are contextual variables that are likely to influence motivation, perhaps together with temperamental sensitivities. Further, other individual-difference variables that may interact with temperament and produce motivationally interesting and important outcomes include, for example, conscientiousness (e.g., Trautwein et al., 2009) or students' perceptions of the utility value of their studies (Eccles, 2009), and these unexamined connections should be accounted for in future research.

Furthermore, the between-subject-domain differences observed in some predictions in Study 2 of Article III suggest that taking into account students' domain-specific perceptions (e.g., Bong, 2001), as well as interpretations of stress as a hindrance or a challenge (LePine et al., 2004) and the role of a supportive classroom atmosphere in these interpretations (Kozusznik et al., 2015) may be helpful. Also, the possibility of effective coping strategies (P.

Evans et al., 2018) and high self-regulatory skills (Scrimin et al., 2018) compensating in some situations for potentially maladaptive effects of, for example, punishment sensitivity should be examined further.

In this thesis, the fear/anxiety (i.e., FFFS/BIS) distinction, which is becoming increasingly important in psychopathological research (see, e.g., Corr & Cooper, 2016), was not considered. While fear responses as defined in the RST may not be common in students' everyday life in the academic environment (see, DeYoung, 2010), individual differences in the sensitivity for fearfulness (see, Corr & McNaughton, 2012) may nevertheless influence motivation. Future research might, therefore, benefit from developing and/or adapting from existing items a larger pool of punishment sensitivity items, in order to examine whether distinguishing between the respective effects of fear and anxiety responses as sub-dimensions of punishment sensitivity would prove salient also for studying motivation in a learning context.

4.5. Conclusions

The research presented in this thesis adds to current knowledge on the dimensionality of temperamental sensitivities, as well as on their differential connections with motivation in various learning contexts, ranging from the early school years to university. Both achievement goal orientations and domain- as well as course-specific motivational appraisals were connected with temperament in theoretically meaningful ways. Furthermore, the connections observed in the respective studies, among different age groups and considering different motivational phenomena, were in line with each other, and thus the respective sets of results reflected and supported the validity of each other.

Temperamental sensitivities are considered to be psychologically deep-rooted. Therefore, the finding that some dimensions are quite consistently associated with educationally more maladaptive motivational tendencies or experiences suggests that some students may inherently be at a greater risk of becoming disadvantaged, even from the early school years onwards. Further research is required to understand how best to counteract this possibility and give students the support they need for positive learning experiences. It is hoped that the findings presented in this dissertation will work towards supporting all students, regardless of their temperamental sensitivities, in discovering the joy of learning.

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