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Relevance of Students' Goals for Learning Engagement and Knowledge Gains in an Online Learning Course

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Abstract: Online courses are an important form of educational delivery worldwide, yet there are large differences in how well different participants learn from them. We strive to better understand these differences and investigate how they are related to participants' motivations and learning gains. Following an achievement goal approach, we distinguish between two mastery goals (task and learning goals) and performance approach and avoidance goals. We constructed an online course including 182 undergraduates and assessed their goals and prior knowledge before, and their knowledge gains after the course. Through learning analytics, we assessed learning engagement based on 9 indicators concerning usage, time, and clicks regarding the different course elements. Structural equation modelling showed that task goals were particularly beneficial for learning engagement, and in turn, learning gains. This paints a more nuanced picture of how mastery goals matter and illuminates how students' goals form a relevant premise for successful online learning.

Introduction

Online courses are a central element of educational systems and are becoming increasingly important. Over the last years, learning with online courses has rapidly increased and has been incorporated in all levels of educational systems (Castro & Tumabay, 2021; Lloyd et al., 2014). For example, in the USA in the academic year 2019-20, the percentage of students enrolled in distance education courses in postsecondary institutions was 51.8% (Hill, 2021)¹. Adding to this, online learning is considered one of the most important forms of educational delivery in the world (e.g., Ng, 2016), and the recent shift to online teaching during COVID-19 provided a glimpse of what more is to come. However, this increasing trend of learning in online courses also comes with challenges, such as lower completion rates and participation (Ng, 2016; Simpson, 2013), making knowledge about how students differ in their engagement and learning within online courses crucial (see also Liu et al., 2009).

Despite the rising use and relevance of online learning, research on factors that drive students to learn successfully in such formats is still nascent. At the same time, knowledge about learning in traditional, face-to-face classroom settings cannot be readily transferred to online learning, as learning in classrooms and online courses systematically diverge: Besides format differences in terms of modes of interaction, accessible information, and (non-)linearity of design (Dettori et al., 2006), online learning is coined by more autonomy on the learner side and the requirement of high self-regulation in learning (Azevedo & Cromley, 2004; Kapp et al., 2015). While design and features of online courses such as social support are important for students' learning therein, learners' characteristics are also highly important and are considered as key competencies for successful online learning (Beaudoin et al., 2009). Within a given online course, there can be vast differences in the extent to which students engage. Consequently, to learn successfully in online courses, high levels of motivation and continuous learning engagement are required and need to be fostered (Simpson, 2008).

In the present research, we strive to better understand differences in learners' engagement in online courses and investigate how these are related to participants' motivations, as well as how they matter for learning performance. To this end, building on previous psychological and educational research, we conceptualize motivation using an achievement goal approach. Combining traditional data collection methods and learning analytics, we show that mastery goals are particularly beneficial for engagement, and in turn, learning gains.

Achievement goals and learning in online courses

Achievement motivation pertains to the energization and direction of competence-relevant behavior and describes why and how people strive toward competence and away from incompetence. As such, motivation is essential for how we experience and behave in achievement contexts, including learning in online courses. Moreover, motivation is dynamic and composed of personal as well as contextual aspects. Thus, for learning in an online course, it is especially important to consider the specific motivations regarding the upcoming course (opposed to general motivational characteristics). This does not (necessarily) reflect why individuals decide to participate in a given course, but rather differences in how they are motivated for this context. A prominent approach in educational psychology to describe such motivations is the achievement goal approach (Elliot & Hulleman, 2017).

Achievement goals represent the “different ways of approaching, engaging in, and responding to achievement situations” (Ames, 1992, p. 261). They form cognitive representations of competence-related end states in achievement contexts that an individual is committed to approach or avoid (Elliot & Hulleman, 2017). Different types of achievement goals with which students approach a particular online course can be distinguished (de Barba et al., 2016). Given that these goals represent what individuals want to reach at the end of their learning, they act as a motivational basis for the interpretation of learning situations and self-regulation therein. Thus, close links with learning engagement and learning outcomes are to be expected. Indeed, previous research has shown that achievement goals are associated with self-regulated learning (Adesope et al. 2015; Zhou, 2013), learning engagement (Froiland & Worrell, 2016; Greene et al., 2004), and academic achievement (Church et al., 2001).

Following this approach, different types of goals have been suggested to matter in achievement contexts. While further distinctions have been discussed (for a contemporary overview see Daumiller et al., 2019), on a minimal level, three fundamental types of goals should be distinguished: mastery, performance approach, and performance avoidance goals. Mastery goals are characterized by a focus on task mastery and improvement. Based on their orientations, they can be distinguished further (see e.g., Daumiller & Zarrinabadi, 2020; Elliot et al., 2011; Hulleman et al., 2010; Korn et al., 2019), most notably depending on whether an individual is oriented at conducting tasks right (here termed *task goals*), or at the improvement of their own competencies (*learning goals*). Given these foci, mastery goals can be considered highly functional in learning contexts for engaged learning and learning gains, as they are focused on increasing levels of competence by acquiring the knowledge or skills that the task develops (Daumiller et al., 2021; Murayama et al., 2012; Payne et al., 2007; Wolters, 2004). It is worth noting that prior research typically assumes that mastery goals matter for learning outcomes through differences in students’ engagement, but empirically, this proposed mediation has seldom been tested (Daumiller et al., 2021).

Opposed to mastery goals, *performance approach goals*² constitute a striving of wanting to be better than others, and *performance avoidance goals* are focused on avoiding doing worse than others. As such, performance approach goals combine a favorable approach-orientation with a focus on performance that serves to keep performance efforts channeled toward normative standards frequently eventuating in high levels of performance (Murayama et al., 2012). However, this might distract from deep learning, as reflected in a meta-analysis by Payne et al. (2007), where no associations with learning gains were found despite increased (adaptive as well as maladaptive) learning processes (e.g., Harackiewicz et al., 2000; Senko & Dawson, 2016). In contrast, performance avoidance goals combine two negative aspects (focus and valence), rendering clearly negative effects. Such goals are linked to anxiety, task distraction, and helpless engagement patterns (Elliot & Church, 1997) and have also been associated with reduced learning gains (Payne et al., 2007) and more maladaptive learning engagement of students in the form of more procrastination, surface processing and disorganization, and less deep processing (Diseth, 2011; Elliot et al., 1999; Elliot & McGregor, 2001; Wolters, 2004).

As described before, these general mechanisms of achievement goals may not readily transfer to online learning contexts (see de Barba et al., 2016). Regarding online learning, only few studies have yet investigated the relevance of achievement goals. However, accumulating evidence points to mastery goals mattering for online learning as well. For example, Xia and Huang (2014) investigated 132 students in a collaborative college-level online course and found that students pursuing strong mastery goals exhibited more frequent participation in online learning activities and reported to have learned a great deal from them. Yeh et al. (2019) found in a sample of 93 undergraduate and graduate students participating in various online courses that only mastery, but not performance goals, were positively related to supportive online learning behaviors and, by extension, expected grades mediated by an increased use of self-regulated learning strategies. Further, de Barba et al. (2016) found that for students participating in a MOOC (Massive Open Online Course), mastery approach goals assessed retrospectively after the course were associated with students’ quiz attempts, and in turn, their final grades. In their study, de Barba et al. (2016) considered quiz attempts as one aspect of engagement, next to video hits.

Interpreting the current state of this line of research, three points should be considered. First, beyond research in the online learning context, mastery goals have typically been considered on a superordinate level in that they are not further distinguished into task and learning goals. Studies across different populations suggest different patterns of learning processes depending on whether individuals are focused on task or learning standards (Daumiller & Dresel, 2020; Elliot et al., 2011; Mascaret et al., 2015b, 2015a; Yang et al., 2016). However, it is not yet clear how task and learning goals might specifically operate for such learning processes. As learning goals are focused on improving own competencies, they might be superior for learning processes compared to strivings focused on doing tasks right, as they may tie learning closer to one’s self-worth. Conversely, task goals might be superior to learning goals in learning settings, as learning goals might distract learners from covering the full breadth of content to be learned (e.g., due to finding certain aspects particularly interesting and placing a focus on them), which might be especially the case in settings with high autonomy requirements (such as learning in online courses). As the research and practical implications drawn from these findings can differ substantially, further

investigations into the different facets of mastery goals are necessary. Adding to this, performance goals are still little understood in online learning contexts, where studies have either omitted them altogether (e.g., de Barba et al., 2016), or have not considered them relevant in remote learning contexts due to a lack of contact with peers (Sachs, 2001). More research is needed to determine their significance, especially as concerns about what others do may still be prevalent despite the actual presence of others. Lastly, in motivation research in general, self-reports are typically used to assess engagement. This can lead to a host of problems associated with same-source bias, desirable answering, and understandability (e.g., Karabenick et al., 2007), which need to be overcome by assessing engagement through other means. In the present work, we therefore consider learning engagement using a broad array of learning analytics indicators concerning how exactly students interacted with the online course.

Learning engagement and learning gains in online courses

Engagement can be defined as the time and energy students invest in educationally purposeful activities (Kuh et al., 2005). Research has consistently found engagement to be a key contributor to success in educational contexts. Importantly, learners who adopt a more engaged approach to learning are more likely to have increased learning gains (e.g., Froiland & Worrell, 2016). However, there is also variability in students' learning engagement, making it necessary to understand what individual factors might lead to different levels of engagement.

For examining learning engagement and outcomes in online contexts in particular, a unique opportunity to capture a more reliable understanding of these interrelations becomes apparent. Learning analytics paired with resulting log data from online courses represent a promising opportunity to measure and analyze how students engage with the different course materials in terms of specific interactions (e.g., views, clicks, posts, scrolls). Such objective indicators of engagement mark an important development within research on student learning, as they have the potential to overcome limitations from self-report measures and are minimally disruptive.

Indeed, several studies have found objective indicators of engagement within online courses to meaningfully represent students' learning involvement and persistence (e.g., Bonafini et al., 2017; de Barba et al., 2015; Phan et al., 2016; Pursel et al., 2016; Xiong et al., 2015). These objective forms of engagement have also been linked to different learning outcomes in theoretically sensible ways. For example, Bonafini et al. (2017) found that students who participated in a MOOC had a higher probability of course achievement when they completed more forum posts and watched more videos. Moreover, as previously noted, de Barba et al. (2016) defined students' engagement as their video hits and quiz attempts within a MOOC, which were positively linked to their interest and final grades. Adding to this, Xiong et al. (2015) assessed students' engagement in a MOOC as a latent variable through the indicators of: videos watched, forum posts, and number of assignments and quizzes completed—which was found to be positively predicted by motivation and resulted in higher student retention. To this end, construing engagement as a latent variable may be particularly advantageous to reflect the overarching psychological construct of engagement as opposed to only focusing on single indicators.

In terms of differentiating which objective indicators of learning engagement within online courses are better to investigate than others, a consensus within the literature has yet to be reached (see Agudo-Peregrina et al., 2014). Nevertheless, important criteria can be drawn from prior studies (e.g., Bonafini et al., 2017; de Barba et al., 2016; Xiong et al., 2015): To provide more comprehensive and reliable insights, several objective indicators of engagement should be simultaneously examined. Moreover, certain indicators—particularly page views, video views, and interactions with quizzes and assignments—have consistently been found to be meaningfully and significantly related to students' learning outcomes. These specific indicators are also commonly reported within studies investigating objective learning engagement in online courses and can therefore be more readily compared with existing research. Based on these considerations, in the present study, we considered the objective engagement indicators of page views (regarding core lessons, additional information, videos, and quizzes), clicks (within core lessons, additional information, assessments, and quizzes), and total time spent on the course.

The present research

As online learning continues to expand in higher education, the effects of pursuing different achievement goals on learners' engagement in online courses and the resulting learning gains need to be analyzed in more depth. In the present research, we aim to follow up on this research gap. Besides considering achievement goals in detail by distinguishing task and learning facets of mastery goals, we consider learning engagement based on multiple objective indicators. To test the relevance of achievement goals for learning engagement in online learning courses and how this consequently matters for learning gains, we put forth the following hypotheses based on the theoretical and empirical points previously discussed:

Hypothesis 1: Task and learning goals are positively associated with learning engagement.

Hypothesis 2: Performance avoidance goals are negatively associated with learning engagement.

Hypothesis 3: Learning engagement is positively associated with learning gains.

Given the unclear nature of performance approach goals, we did not formulate a directed hypothesis for this type of goal. Further, we presumed that both task and learning goals would result in positive effects, but tested for potential differences between these two facets of mastery goals on an explorative level.

Method

To answer our research questions, we constructed an online course on psychological research methods embedded in the curriculum of a psychology lecture and invited 182 students to participate in it over two weeks in November 2019. The study was conducted in full accordance with the Ethical Guidelines of the German Association of Psychologists and the American Psychological Association. Full anonymity of all participants was assured. We had no reason to assume that completing our survey would have any negative effects on the participants. We provide the online course used as an open educational resource and provide all data and code underlying this research in an open repository (<https://osf.io/gp6h3/>).

Participants and procedure

The participants of this study included students attending an introductory lecture on psychology. Typical for this population, participants were mostly women (135 identified as women, 45 as men, 2 as diverse), had an average age of 21.4 ($SD = 2.6$) years, and were in their first year of university. It should be noted that the students had not yet dealt with the topic of the online course (research methods) within their curriculum.

The online course contained 3 core lessons (including 10, 3, and 9 pages of learning content, respectively), 3 videos, 7 pages of additional helpful information, 16 quizzes, and 3 end-of-lesson assessments. It was constructed based on an earlier online course developed by Daumiller and Dresel (2019) and piloted regarding understandability, relevance of content, potential technological problems, and ease of use with five students. The average time spent on the online course was 122 minutes ($SD = 70$). When accessing the online course for the first time, participants were asked to complete a survey assessing their achievement goals and baseline knowledge. During the online course, we measured their learning engagement in the form of log data corresponding to the indicators of views, clicks, and total time. Directly after completing the online course, the students were required to participate in another knowledge test covering the topics within the course to gauge their learning gains.

Measures

We used the scale by Daumiller et al. (2019) to measure task approach (3 items; e.g., "... my goal is to fulfill the different requirements very well"; $\omega = .90$), learning approach (4 items; e.g., "... my goal is to expand my knowledge as much as possible."; $\omega = .93$), performance approach (4 items; e.g., "... my goal is to be better than the other students."; $\omega = .94$), and performance avoidance (4 items; e.g., "... my goal is not to be worse than the other students"; $\omega = .94$) goals. All items were directed at the online course (item stem: "In this online course...") and answered on a 8-point Likert-type scale ranging from 1 (*do not agree at all*) to 5 (*agree completely*).

As indicators of students' engagement during the course, we used log data concerning (a) the total amount of time students spent on the course, (b) how many times they viewed core lesson pages, (c) how many videos they viewed, (d) how many times they viewed additional information pages (containing supplemental information such as tips for reading research articles and a dictionary with key words), (e) how many times they viewed quizzes, (f) how active they were within the core lesson pages, (g) how active they were within the additional information pages, (h) how many answers they submitted within the assessments, and (i) how many answers they submitted within the quizzes. We modeled residual correlations between closely corresponding and partly dependent indicators (e.g., lesson views with lesson clicks). A CFA confirmed the presumed one-dimensional structure and supported modelling engagement as a latent factor ($CFI = .97$, $TLI = .95$, $SRMR = .05$).

We measured students' content knowledge concerning the online course by administering a slightly adapted and expanded multiple-choice test by Daumiller and Dresel (2019) containing 4 questions before the start of the course as well as the same questions along with 6 further, more difficult questions after the students finished the online course. Based on the proportion of correct items (pretest: $M = .64$, $SD = .13$, $Min = .19$, $Max = .88$; posttest: $M = .65$, $SD = .11$, $Min = .38$, $Max = .90$) we subsequently computed the residual change scores between these two knowledge test scores to describe students' learning gains during the course. Given that the post-test was more difficult than the pre-test, it should be noted that the change scores do not reflect the absolute amount of learning gains for each student (which we were not interested in), but instead allows us to quantify differences between the participating students with regard to their learning gains.

Analyses

We estimated a structural equation model in which learning gains were regressed on learning engagement (as a latent variable based on nine indicators) that was in turn regressed on the four achievement goals. We allowed for

direct effects from goals on learning gains. We estimated the direct effects as standardized partial regression coefficients and obtained indirect effects by combining the specified coefficients for direct effects; their statistical significance was tested with z-tests. The model was estimated in R version 4.1.1 (R Core Team, 2021) using the lavaan package version 0.6-9 and MLR as an estimator. There was no missing data.

Results

We present descriptive statistics as well as bivariate correlations between all variables in Table 1. In line with prior research on achievement goals, we found rather high levels of task and learning goals and lower levels of performance goals. All goals contained substantial amount of intra-individual variability, indicating that students started the course with different compositions of goals.

The results of the SEM (CFI = .96, TLI = .95, SRMR = .05) are visualized in Figure 1 and indicate that task approach goals had a positive, statistically significant effect on learning engagement, while learning approach goals and the two performance goals did not. Engagement in turn had a positive, statistically significant effect on learning gains. According to Acock (2014) both effects can be considered as moderate. Further, there was a small, statistically significant indirect effect from task goals via engagement on learning gains ($\beta = .05, SD = .02$).

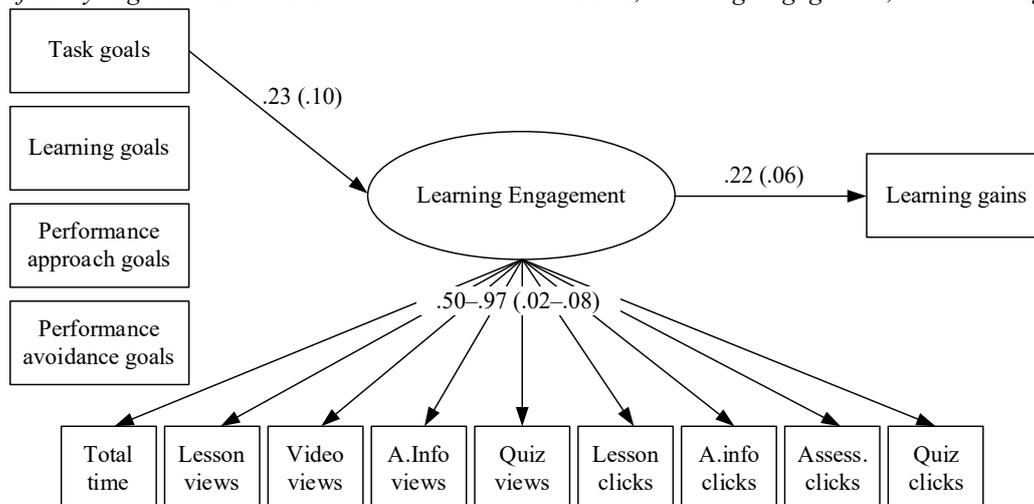
Table 1
Descriptive Statistics and Bivariate Correlations

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
Achievement goals															
[1] Task approach goals	3.92	0.83													
[2] Learning approach goals	4.08	0.80	.69												
[3] Performance approach goals	2.15	1.00	.05	-.11											
[4] Performance avoidance goals	2.59	1.06	.15	.04	.74										
Learning engagement															
[5] Total time	122	70.3	.11	.04	-.02	.07									
[6] Lesson views	42.7	23.6	.08	-.01	-.07	.02	.54								
[7] Video views	1.75	2.27	.20	.07	.03	.05	.45	.48							
[8] Additional information views	9.27	8.74	.22	.13	-.05	-.04	.45	.38	.47						
[9] Quiz views	32.0	18.0	.10	.04	-.09	-.03	.45	.88	.51	.39					
[10] Lesson clicks	54.9	31.9	.09	-.01	-.06	-.01	.58	.95	.56	.45	.87				
[11] Additional information clicks	14.7	12.5	.20	.05	-.01	.04	.52	.65	.80	.66	.63	.72			
[12] Assessment clicks	13.4	10.3	.17	.07	-.04	.05	.43	.62	.49	.46	.75	.71	.60		
[13] Quiz clicks	25.7	14.3	.08	.03	-.10	-.05	.42	.87	.46	.34	.97	.83	.58	.57	
Learning gains	0.00	0.11	.07	.07	-.10	-.11	.25	.21	.18	.32	.18	.21	.12	.15	.17

Note. All $|r| > .14$ statistically significant at $p < .05$, $|r| > .19$: $p < .01$.

Figure 1

Results of Analyzing the Associations Between Achievement Goals, Learning Engagement, and Learning Gains



Note. Only statistically significant effects are visualized. Residuals and their correlations are not presented.

Discussion

As online courses are an important form of educational delivery worldwide, yet students vary substantially in how well they learn from them, we aimed to investigate differences in students' engagement and how they are related to participants' motivations and learning gains. Following an achievement goal approach, we distinguished between two mastery goals, namely task and learning goals, and included performance approach and avoidance goals. Besides this detailed view on students' goals, we expanded prior motivation research that primarily relied on self-reports by combining traditional data collection methods and novel learning analytics techniques, measuring learning engagement based on a broad variety of objective indicators. Our finding that especially task goals are beneficial for learning engagement, and in turn learning gains, paints a more nuanced picture of how mastery goals matter, and illuminates how students' goals form a relevant premise for successful online learning.

Confirming our expectations and in line with prior findings (e.g., Bonafini et al., 2017; de Barba et al., 2016), we found that learning engagement measured via objective indicators within the online course did indeed matter for students' learning gains. It should be borne in mind that our measure primarily focused on behavioral aspects of engagement; an increased relevance of engagement might have been found had we also considered cognitive and affective aspects more strongly. This highlights the importance of designing online courses in ways that spur engagement, as well as considering the role of personal learner characteristics that might impact learning engagement. Regarding the latter suggestion, our findings indicate that students' motivations expressed in the form of achievement goals constitute personal factors that impact their engagement within online courses.

In terms of the linkages with learning engagement, our findings support that across different types of learning environments, mastery approach goals are positively related to learning outcomes (see Belenky & Nokes-Malach, 2012). The finding that especially task goals (when compared with learning goals) matter for learning engagement and learning gains, requires a closer look into the relevance of mastery goals. Our findings imply that task and learning goals might indeed differ in how they matter for student learning (Daumiller & Dresel, 2020; Elliot et al., 2011; Mascret et al., 2015b, 2015a; Yang et al., 2016). Regarding learning processes, at least within clear learning contexts such as online courses, it might be the case that task goals are superior to learning goals, as learning goals might distract learners from covering the full breadth of content to be learned (e.g., due to finding certain aspects particularly interesting and focusing on them), which might especially be the case in settings with high autonomy requirements (such as learning in online courses). Here it should be considered that we designed the knowledge tests to operationalize learning gains by content-validly reflecting the full range of content within the course. This focus aligns with the notion that learning goals may foster deeper specialized knowledge gain, as opposed to an understanding of all relevant content to be learned. Future research might follow up on this by conducting interviews to inquire about students' learning processes in more detail. Another important take away is that although we also examined performance goals, no statistically significant effects were identified for this goal type with learning engagement or learning gains. This might be a function of the features of the online course, which included little opportunity for normative comparisons (e.g., no opportunity to compare quiz/assessment scores). Therefore, future research should consider a broad array of course features and how these might matter for the effects of performance goals.

When interpreting our findings, two key limitations need to be considered. Firstly, we considered a single online course with unique features, limiting generalizability and comparability of our findings. One way to address this could be extending the present study to courses with different designs. Second, we focused on engagement from an objective and behavioral perspective, however, additionally assessing emotional and cognitive facets of engagement would be an interesting and important direction for future research. Nevertheless, our findings already point to first practical implications. Specifically, task goals should be supported to allow for more successful online learning experiences. This may be facilitated through: (1) directly influencing these goals by stressing the importance of task mastery and putting the respective goals into writing; and (2) supporting these goal striving processes by an arrangement of contextual features emphasized in the online course (Lüftenegger et al., 2014).

In conclusion, our findings contribute to better understanding how established models of educational research can be applied to shed light on students' engagement and learning gains in the increasingly important context of online learning. While online courses may differ in design and support provided, personal learner characteristics such as their motivations should not be neglected. Our findings show that students' goals, and in particular, their task goals, are relevant for engaging more in online courses and taking more away from them.

Endnotes

- (1) Given the aberrations of 2020 and 2021 data due to COVID-19, we rely on the data before COVID-19 as an indicator of how widespread the use of online learning courses has become (Hill, 2021).
- (2) Similar to mastery goals, performance goals can be further distinguished based on whether they are directed at normative comparisons regarding performance (normative goals), or at competence demonstration (appearance

goals). For theoretical and conceptual clarity, we focus performance goals in the present work exclusively on normative comparisons (in line with Elliot & Murayama, 2008; Elliot et al., 2011).

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