

This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.

Author(s): Grassinger, Robert; Landberg, Monique; Määttä, Sami; Vasalampi, Kati; Bieg, Sonja

Title: Interplay of intrinsic motivation and well-being at school

Year: 2024

Version: Published version

Copyright: © The Author(s) 2024

Rights: CC BY 4.0

Rights url: <https://creativecommons.org/licenses/by/4.0/>

Please cite the original version:

Grassinger, R., Landberg, M., Määttä, S., Vasalampi, K., & Bieg, S. (2024). Interplay of intrinsic motivation and well-being at school. *Motivation and Emotion*, Early online.
<https://doi.org/10.1007/s11031-024-10057-2>



Interplay of intrinsic motivation and well-being at school

Robert Grassinger¹ · Monique Landberg¹ · Sami Määttä² · Kati Vasalampi³ · Sonja Bieg¹

Accepted: 30 December 2023
© The Author(s) 2024

Abstract

Feeling well at school is crucial for both young people's healthy self-development and their intrinsic learning motivation. Both concepts, subjective well-being and intrinsic motivation, are central to self-determination theory, but their reciprocal relationship is not studied very well. We hypothesized that the concepts affect each other directly: Students who are intrinsically motivated feel well at school due to positive emotions and the strive for understanding the learning content, which is an intrinsic motivation immanent. Beyond, students who feel well at school are intrinsically motivated, because subjective well-being represents an intrinsic value of the learning situation. This hypothesis is tested using a sample of 773 secondary school students (mean age: 12.7 years, $SD = 1.8$), who were answering questionnaires at the beginning (T1), at mid (T2) and at the end (T3) of a school year. The data were analyzed using a cross-lagged panel model. The results gave evidence on cross-lagged effects and an indirect effect from subjective well-being to intrinsic motivation to subjective well-being.

Keywords Intrinsic motivation · Subjective well-being · Self-determination theory · Secondary school · Cross-lagged panel model

Introduction

Students at school interact with different people such as their schoolmates and teachers. They laugh, get angry, talk, and discuss with each other, and so on. All these interactions are associated with students' subjective well-being at school and are very important for their healthy self-development (Schwarz-Mette et al., 2020). Further, students learn and perform at school and develop knowledge and competences not only but also in different school subjects. Learning processes go well and for the most part better when students are intrinsically motivated (Ryan & Deci, 2000). So, it is important for school teachers to design a learning environment that favors students' subjective well-being at school as well as students' intrinsic learning motivation (Dinisman et al., 2015). Work done by Bieg et al. (2013), Hascher and Hagenauer (2018) or Virtanen et al. (2019) give evidence, that teachers' social interactions with their

students and their instructional design have the power to promote both, students' subjective well-being and intrinsic motivation. Especially, fostering basic psychological needs like the need for relatedness, for autonomy and for competence can favor students' subjective well-being and intrinsic motivation (Boncquet et al., 2020; Bieg & Mittag, 2009; Ryan & Deci, 2017, 2020).

Beyond, it seems that subjective well-being and intrinsic motivation are related with each other (Ryan & Deci, 2020). Students who feel well at school report higher intrinsic motivation and vice versa. Less is known about the causality of this relationship. Is it the way that feeling well at school promotes intrinsic motivation or is it the way that students' intrinsic motivation promotes their well-being at school? Theoretically, both processes are possible: On the one hand, subjective well-being in learning situations represents a value of these situations, so subjective well-being can be one situational cause for intrinsic learning motivation (Ryan & Deci, 2017). On the other hand, intrinsic motivation is associated with positive emotions and the strive for understanding the learning content, which can promote subjective well-being (Hope et al., 2019). This paper addresses this reciprocal relation of intrinsic motivation and subjective well-being and aims to get a deeper understanding on the causality of this relationship.

✉ Robert Grassinger
grassinger@ph-weingarten.de

¹ University of Education Weingarten, Weingarten, Germany

² Tampere University, Tampere, Finland

³ University of Jyväskylä, Jyväskylä, Finland

Self-determination theory as a framework for the relationship of well-being and intrinsic motivation

To understand the interplay of subjective well-being and intrinsic motivation we refer to the self-determination theory (SDT; Deci & Ryan, 2000; Ryan & Deci, 2017, 2020). Deci and Ryan (2000) argue that “[...] human needs specify the necessary conditions for psychological health or subjective well-being and their satisfaction is thus hypothesized to be associated with the most effective functioning” (p. 229). The needs for competence, relatedness, and autonomy are postulated as human necessities and universal basic psychological needs. The need for competence addresses one’s desire to feel as a causal agent with respect to one’s own actions. The need for relatedness can be characterized as the desire to feel connected to others. Finally, the need for autonomy is defined as the desire to self-organize experience and behavior and have one’s activities be concordant with one’s integrated sense of self (Deci & Ryan, 2000; Ryan & Deci, 2000). The quotation above illustrates the assumption that the satisfaction of these needs in specific situations favor subjective well-being. Empirically, León and Núñez (2013) found that the satisfaction of the need for relatedness and the need for competence positively affect university students’ subjective well-being at university.

Intrinsically motivated behavior, defined as freely engaged behavior out of pleasure and interest without the necessity of separable consequences, is based on the satisfaction of the mentioned basic needs. In detail, Deci and Ryan (2000) argue that especially the satisfaction of the need for competence and for autonomy are required for intrinsic motivated behavior. As mentioned, basic need satisfaction fosters well-being of the individual as well (Ryan & Deci, 2000). As a consequence, it is theoretically plausible that subjective well-being and intrinsic motivated behavior are related due to their common factors involved – the satisfaction of the basic needs. This argumentation is supported by empirical work, which gives evidence on the correlation of subjective well-being and intrinsic motivated behavior (Martinek et al., 2021; Milyavskaya & Koestner, 2011; Ryan et al., 1995, 1996). For example, Ryan et al. (1995) found that intrinsically motivated people report more subjective well-being compared with external motivated people.

Effects of intrinsic motivation on well-being

Research on subjective well-being is grounded in two general perspectives (Ryan & Deci, 2001): the first one is

called hedonic view on well-being and is characterized by a strong focus on happiness. It defines well-being in terms of pleasure attainment and pain avoidance. Indicators are life satisfaction and happiness in terms of presence of positive mood and absence of negative one (Diener & Lucas, 1999). The second one is called eudemonic view and focuses on self-realization and meaning of life. It defines well-being in terms of the degree to which a person is fully functioning (Ryan & Deci, 2001). Indicators are congruent activities to ones’ deeply held values and feelings like being alive and authentic.

Intrinsic motivation is—per definition—characterized by pleasure and interest. In other words, students, who are intrinsically motivated in learning situations, enjoy these situations and aim to understand the learning content. We argue that intrinsically motivated learning situations promote well-being due to these positive emotions (hedonic view on well-being) and due to the strive for understanding the learning content (eudemonic view on well-being).

Empirical evidence on this argumentation is given by Hope et al. (2019). The authors examined university students for five times throughout a period of one school-year and analyzed the data with a cross-lagged structural equation model. Hereby they identified a positive effect from intrinsic aspirations to improved subjective well-being over time. Furthermore, Sheldon and Kasser (1998), who asked university students during their progress toward personal goals, concluded that intrinsic motivated goals have the power to improve subjective well-being. Additionally, Burton et al. (2006) found consistent results with elementary school students and university students showing that intrinsic motivated learning behavior caused psychological well-being. Furthermore, a recent study across two countries with university students showed that students’ intrinsic motivation is a positive predictor for their subjective well-being (Martinek et al., 2021) (Fig. 1).

Effects of subjective well-being on intrinsic motivation

As already mentioned above, intrinsic motivation is defined as freely engaged behavior out of pleasure and interest without the necessity of separable consequences. Well-being is characterized by low negative affect, high positive affect, congruent activities to ones’ values and feelings and life satisfaction (Deci & Ryan, 2000; Diener et al., 1999; Marsh et al., 2006). Based on this definition and characteristics we argue that well-being is pleasure due to its characteristics of having more positive and less negative affect. Further we argue that well-being goes along with interest, because it is characterized by congruent activities to ones’ deeply held values. In other words, situations or activities in which people feel well, are those out of pleasure, thereby fostering intrinsic motivation to

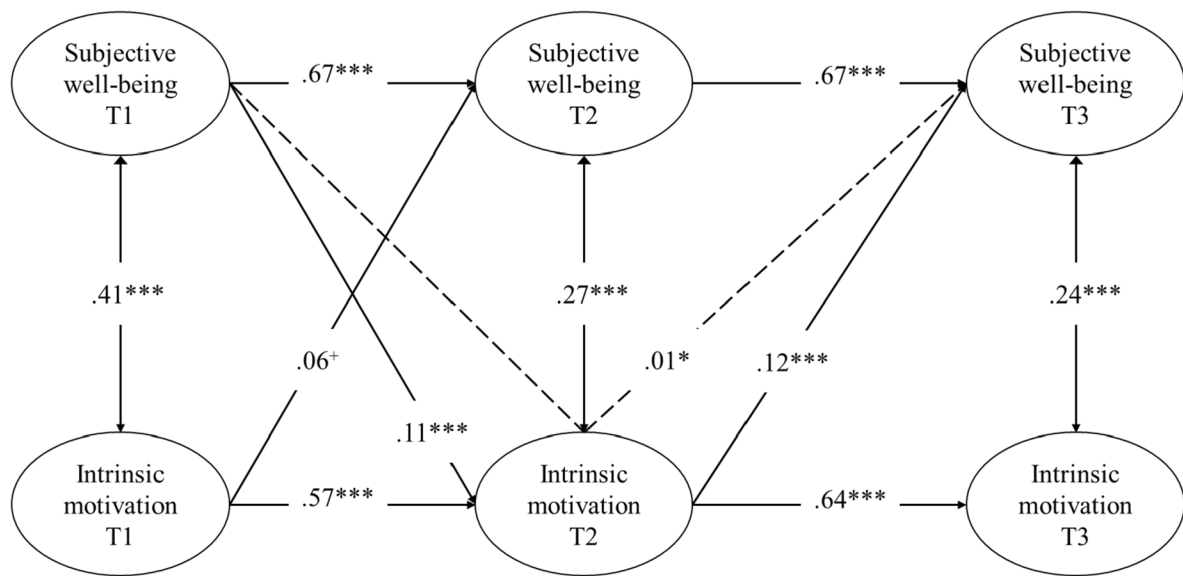


Fig. 1 Cross-lagged model of intrinsic motivation and well-being in the classroom. Standardized coefficients, one-tailed, *** $p < .001$, * $p < .05$, ⁺ $p < .10$. Significant direct (solid lines) and indirect (dotted lines) paths are displayed

seek out or engage in these situations or activities. For example, if someone feels well while climbing or engaging with history, this, due to the joy or out of pleasure involved, fosters intrinsic motivation for that person to climb or delve into history. Beyond this assumed effect of well-being on intrinsic motivation, which is primarily based on both definitions, also the Four-Phase Model of Interest Development by Hidi and Renninger (2006) and findings by Ryan and Frederick (1997) and Kawabata et al. (2017) give evidence for the assumed effect. People who feel well during an activity show higher subjective vitality (Kawabata et al., 2017; Ryan & Frederick, 1997). Thus, they have more energy for personal involvement. Both, this personal involvement and positive feelings, which characterize well-being, are central aspects for the development of Maintained Situational Interest, Emerging Individual Interest, and Well-Developed Individual Interest (Hidi & Renninger, 2006). In a nutshell, well-being can promote intrinsic motivation because it goes along with pleasure and interest, core definitional aspects of intrinsic motivation. In our understanding this assumed effect is consistent with the assumptions of the self-determination theory, because our argumentation is primarily based on the definition and characteristics of the two concepts, but hardly studied. To the best of our knowledge former work focused stronger on the (bidirectional) relationship of intrinsic motivation and well-being (Milyavskaya & Koestner, 2011; Ryan et al., 1995, 1996) and on the effect of intrinsic motivation on well-being (Burton et al., 2006; Hope et al., 2019; Martinek et al., 2021; Sheldon &

Kasser, 1998). Less work is done to proof the assumption that well-being affects intrinsic motivation.

The present study

As outlined above, there is theoretical and empirical evidence that intrinsic motivation and subjective well-being are correlated. This relationship can be understood due to the satisfaction of the need for competence and autonomy, which are common factors of both, intrinsic motivation and subjective well-being (Milyavskaya & Koestner, 2011; Ryan et al., 1995, 1996). Beyond this relationship we argue that there are also effects of intrinsic motivation on subjective well-being and of subjective well-being on intrinsic motivation. The first one is based on positive emotions and the strive for understanding the learning content, which characterizes different forms of interest. The second one is based on the argumentation that subjective well-being in situations represents an intrinsic value of this situation, which leads to intrinsic motivation. The aim of the present study is to test the hypothesis that intrinsic motivation and subjective well-being affect each other.

Method

Procedure and participants

The study was conducted on three measurement points within one school year. The first measurement (T1) took

place in October. The second measurement point (T2) was about 4 to 5 months later (February/March) and the third measurement occasion (T3) was again after 4 to 5 months (June/July) at the end of the school-year. School students were assessed by online-questionnaires and consent by them and their parents was given before data collection took place. The sample consisted of 773 students (T1) from different grades (5 to 10) out of three secondary schools in Germany (“Gymnasium”) with a mean age of 12.7 years ($SD = 1.8$; T1). In detail, 13% of the students were 5th graders, 21% 6th graders, 22% 7th graders, 10% 8th graders, 21% 9th graders, and 13% 10th graders. Male ($n = 398$; 51.5%) and female students ($n = 375$; 48.5%) were nearly uniformly distributed. 66.6% of the 773 students answered the questions at all three measurement points, 19.7% of the students participated at the first and the third measurement points, and 13.7% of the students contributed at the first and second measurement points.

Measures

Subjective well-being

Subjective well-being was assessed with six items and a focus on the classroom as the part of school where students spend their most time. Hence, the construct represents subjective well-being in the classroom and not subjective well-being in a broader way. “Our classroom invites me to linger” and “Being in our classroom feels good to me” are two examples of the items. The response format ranged from 1 (*applies not at all*) to 6 (*totally applies*). Cronbach’s Alpha varied from .92 to .95.

Intrinsic motivation

Intrinsic motivation was assessed with a modified version of the Self-Regulation Questionnaire by Bieg and Mittag (2005) using four items. The scale was validated in former studies (e.g., Bieg et al., 2011, 2013). An example item was “I work well in [subject] lessons because I enjoy it.” The subject was English in grade 5 and 9, History in grade 6 and 8 and Mathematics in grade 7 and 10. The response format ranged from 1 (*not at all true*) to 4 (*very true*). Cronbach’s Alpha varied from .93 to .94.

Analyses

In a first step, we analyzed if the items of the used scales measured intrinsic motivation and well-being as two different constructs. For this, we compared the model-fit of a one-factor model (all items load on one factor) with the model-fit of the assumed two-factor model (the specific items load on the factors intrinsic motivation and well-being) for each

measurement point separately. For the one-factor model the model-fit was unsatisfactory at each measurement point (T1: $CFI = .620$, $TLI = .506$, $RMSEA = .297$, $AIC = 20,086$, $BIC = 20,226$; T2: $CFI = .620$, $TLI = .511$, $RMSEA = .324$, $AIC = 15,914$, $BIC = 16,047$; T3: $CFI = .627$, $TLI = .520$, $RMSEA = .328$, $AIC = 17,174$, $BIC = 17,309$), whereas for the two-factor model the model-fit was better at each measurement point and mainly satisfactory (T1: $CFI = .954$, $TLI = .940$, $RMSEA = .104$, $AIC = 17,996$, $BIC = 18,140$; T2: $CFI = .959$, $TLI = .946$, $RMSEA = .108$, $AIC = 13,877$, $BIC = 14,014$; T3: $CFI = .948$, $TLI = .931$, $RMSEA = .124$, $AIC = 15,019$, $BIC = 15,158$).

In a second step, we run the measurement model considering both, intrinsic motivation and well-being as the two factors for all three measurement points and their factor loadings. This measurement model ($CFI = .940$, $TLI = .933$, $RMSEA = .064$, $SRMR = .035$) with the factor loadings and the correlations between the factors is attached as supplementary material. Further we analyzed the descriptive statistics and the changes of subjective well-being and intrinsic motivation over time. In a third step, the reciprocal association of intrinsic motivation and well-being was analyzed by identifying a crossed-lagged panel model with latent variables measured at three occasions throughout one school year. Cross-lagged models are suitable to examine cross-path between variables in a longitudinal manner and indicate causal effects (Reinders, 2006). In detail, subjective well-being, assessed in measurement point 2 respective 3 was regressed on subjective well-being and intrinsic motivation, assessed in measurement point 1 respective 2. In the same manner, intrinsic motivation was regressed on former intrinsic motivation and subjective well-being. Bivariate correlations were allowed for subjective well-being and intrinsic motivation within each measurement point, but not between the measurement points. Further, two indirect effects were modelled: From subjective well-being (T1) via intrinsic motivation (T2) to subjective well-being (T3) and from intrinsic motivation (T1) via subjective well-being (T2) to intrinsic motivation (T3). Missing data were estimated by using the Full Information Maximum Likelihood Method. All analyses were done using R (R Core Team, 2021).

Results

Descriptive statistics and changes over time

In Table 1, the descriptive statistics and the bivariate correlations of subjective well-being and intrinsic motivation is presented. All variables are significantly correlated to each other. Over time, subjective well-being ($r = .66-.69$) and intrinsic motivation ($r = .51-.61$) are moderate to strong related to each other. Repeated measure

Table 1 Descriptive statistics and bivariate correlations of subjective well-being and intrinsic motivation at the beginning, the mid, and the end of the school year

	Range	M	SD	(1)	(2)	(3)	(4)	(5)	(6)
(1) Subjective well-being_T1	1–6	3.33	1.15	1					
(2) Subjective well-being_T2	1–6	3.22	1.20	.68	1				
(3) Subjective well-being_T3	1–6	3.24	1.22	.66	.69	1			
(4) Intrinsic motivation_T1	1–4	2.33	0.89	.40	.33	.31	1		
(5) Intrinsic motivation_T2	1–4	2.26	0.90	.33	.42	.41	.60	1	
(6) Intrinsic motivation_T3	1–4	2.28	0.93	.31	.24	.38	.51	.61	1

All bivariate correlations are significant on $p < .001$. T1 to T3 stands for the measurement points at the beginning (T1), the mid (T2), and the end (T3) of the school year

analyses of variance revealed no significant changes over time for intrinsic motivation ($F(2) = 1.87$, $p = .155$), but for subjective well-being ($F(2) = 6.81$, $p < .001$). With a focus of each measurement point subjective well-being and intrinsic motivation were moderate correlated ($r = .38$ – $.42$).

Results on the hypotheses

The model yielded a mainly satisfactory fit ($\chi^2 = 1694.16$, $df = 394$, $p < .001$; $CFI = .936$, $TLI = .930$, $RMSEA = .06$, $SRMR = .05$). Results from the analyses indicated the standardized autoregressive coefficients for subjective well-being between T1 and T2, $\beta = .67$, $p < .001$, and between T2 and T3, $\beta = .67$, $p < .001$. The autoregressive coefficients for intrinsic motivation between T1 and T2 was $\beta = .57$, $p < .001$, and between T2 and T3 was $\beta = .64$, $p < .001$. Further, within the measurement points 1 to 3 subjective well-being and intrinsic motivation were positively correlated, which varied between $r = .41$ ($p < .001$; T1), $r = .27$ ($p < .001$; T2), and $r = .24$ ($p < .001$; T3). At the beginning, at the mid, and at the end of a school year feeling well within ones' classroom was positive associated with intrinsic motivation. The explained variance varied from $R^2 = .49$ (T2) to $.54$ (T3) for subjective well-being and from $R^2 = .39$ (T2) to $.40$ (T3) for intrinsic motivation.

Testing the effect of subjective well-being on intrinsic motivation the model identified one significant effect: Subjective well-being at Time 1 predicted intrinsic motivation at Time 2 ($\beta = .11$, $p < .001$). There was no significant effect for subjective well-being at Time 2 on intrinsic motivation at Time 3. Students, who feel well in their classroom at the beginning of the school year reported higher intrinsic motivation four to five months later. For the second part of the school year this effect could not be confirmed.

Testing the effect of intrinsic motivation on subjective well-being two path coefficients were (slightly) significant: Intrinsic motivation at Time 2 affected subjective well-being at Time 3 ($\beta = .12$, $p < .001$) and intrinsic motivation at Time 1 was a predictor of subjective well-being at Time 2 ($\beta = .06$, $p < .10$). Students who were intrinsically motivated in the beginning respective middle of a school year reported higher

subjective well-being in the mid respective at the end of a school year.

Further, there was a small but significant indirect effect from subjective well-being (T1) via intrinsic motivation (T2) to subjective well-being (T3) ($\beta = .01$, $p < .05$). This effect illustrates that students who feel well in the classroom, tend to be more intrinsically motivated, which in turn supports well-being in the classroom.

Discussion

The paper focused on the relationship of subjective well-being in classrooms and intrinsic motivation for learning activities. The findings indicated that at all three measurement points subjective well-being and intrinsic motivation were correlated positively. This is in accordance to prior findings and the assumptions of the self-determination theory (Reis et al., 2000; Ryan & Deci, 2017, 2020; Sheldon et al., 1996). In our understanding, this positive correlation is theoretically based on the satisfaction of the basic psychological needs of competence, autonomy and relatedness as common antecedents of subjective well-being and intrinsic motivation (Boncquet et al., 2020; Martinek et al., 2021; Milyavskaya & Koestner, 2011; Ryan et al., 1995, 1996; Sheldon et al., 1996). For example, Boncquet et al. (2020) reported evidence that both, the level, and the increase in autonomous motivation was positively associated with the level and the increase of subjective well-being at school.

Beyond this, we argued that subjective well-being and intrinsic motivation affect each other directly because of two processes: (1) Intrinsic motivation is associated with positive emotions and a strive for understanding the learning content, which in turn favors subjective well-being in a hedonic and eudemonic understanding. (2) Subjective well-being in learning and achieving situations is associated with positive emotions and high personal values (i.e., of the learning content), which in turn favors intrinsic values of the situations. The findings revealed cross-lagged effects and an indirect effect from subjective well-being via intrinsic motivation to subjective well-being. In other words, we

found first evidence on a reciprocal relationship of subjective well-being and intrinsic motivation. More specifically, the effect of intrinsic motivation on subjective well-being is consistent to work done by Burton et al. (2006), Hope et al., (2019) and Sheldon and Kasser (1998). However, the effect of well-being on intrinsic motivation was hardly studied. The findings support the idea that subjective well-being in the classroom can be understood as an intrinsic value for learning and achieving activities at school. In other words, promoting students' subjective well-being in the classroom at the beginning of a school year can foster students' intrinsic motivation for learning and achieving. More generally, it seems that the positive relationship of subjective well-being and intrinsic motivation is not only based on the satisfaction of the basic needs, but also on positive emotions, striving for understanding the learning content, and high personal values as antecedents and consequences of intrinsic motivation and subjective well-being. But it has to be mentioned that these reciprocal effects are only confirmed solidly for two of four possible cross-lagged effects, and that the satisfaction of the basic needs, which promotes both, intrinsic motivation and well-being (Ryan & Deci, 2000), was not controlled for in the analyses. Further work is needed to replicate the causal effects in general and specifically considering the satisfaction of the basic needs.

The moderate autoregressive coefficients indicate that both, students' subjective well-being in classroom and their intrinsic motivation for learning and achieving activities change within one school year. The theoretical argumentation and the reported empirical findings in mind: an instructional design which fosters the satisfaction of students' basic needs, promotes positive emotions, and highlights both an understanding of and students' personal values (i.e., attainment value) of the learning content can strengthen students' intrinsic motivation and subjective well-being (Ryan & Deci, 2009). Beyond, the *what* and *how* of learning, the *where* seems to be relevant as well. There is some evidence that school architecture in general (Capolongo, 2014) and interior architecture specifically (Petermans & Pohlmeier, 2014) can also promote subjective well-being. For example, Petermans and Pohlmeier (2014) state that "inner environments could aim to stimulate experiences that provide pleasure and meaning to its inhabitants" (p. 206).

The study design which aimed at analyzing the reciprocal relations between intrinsic motivation and subjective well-being and the use of latent data are strengths of the present study. However, considering that recent work supports the idea that subjective well-being at school can be understood as a multicomponent model which encompasses cognitive, affective, social and physical well-being (Kanonire et al., 2020; Kleinkorres et al., 2020), it has to be mentioned as a limitation, that subjective well-being was not operationalized considering cognitive, affective, social, and physical

components. Kanonire et al. (2020) revealed in their study, that behind these components a general factor of subjective well-being can be assumed. Thus, the presented results can somehow be generalized to all components of subjective well-being. Nevertheless, our work could not proof potential different relationships of intrinsic values with these different components of subjective well-being. In the current study, subjective well-being was measured with a focus on the classroom but not with a focus on the instruction of a specific subject like we did when evaluating intrinsic motivation. In consequence due to the asymmetry in the measurement reported effects might have been underestimated. Further, it has to be mentioned that the sample is based on three different upper secondary schools in Germany, which may limit the generalization of the findings. Furthermore, both, intrinsic motivation and subjective well-being can vary from day to day (Reis et al., 2000; Sheldon et al., 1996). These kinds of variation were not considered. Nevertheless, the findings support the idea that intrinsic motivation and subjective well-being are interwoven at least due to three aspects: (i) the satisfaction of the basic needs as common factors of both, (ii) the intrinsic value of the situation students feel well, and (iii) the positive emotions and the striving for understanding the learning content, which is intrinsic motivation immanent.

Funding Open Access funding enabled and organized by Projekt DEAL. The writing of this article was supported by grant from the Academy of Finland (323773) to Kati Vasalampi.

Data availability The data that support the findings of this study are available on RADAR, a Research Data Repository. The corresponding author will send the link to the data upon request.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Research involving human participants and/or animals All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all students included in the study and their parents.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted

use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Bieg, S., Backes, S., & Mittag, W. (2011). The role of intrinsic motivation for teaching, teachers' care and autonomy support in students' self-determined motivation. *Journal for Educational Research Online*, 3(1), 122–140. <https://doi.org/10.25656/01:4685>
- Bieg, S., & Mittag, W. (2005). *Motivational self-regulation questionnaire for adolescents (MoS-A)—Short documentation*. University of Education, Ludwigsburg, Institut für Pädagogische Psychologie und Soziologie.
- Bieg, S., & Mittag, W. (2009). Die Bedeutung von Unterrichtsmerkmalen und Unterrichtsemotionen für die selbstbestimmte Motivation [Effects of classroom conditions and learning emotions on self-determined motivation of adolescents]. *Empirische Pädagogik*, 23(2), 117–142.
- Bieg, S., Rickelman, R., Jones, J., & Mittag, W. (2013). The role of teachers' care and self-determined motivation in working with students in Germany and the United States. *International Journal of Educational Research*, 60, 27–37.
- Bonquet, M., Soenens, B., Verschueren, K., Lavrijsen, J., Flamant, N., & Vansteenkiste, M. (2020). Killing two birds with one stone: The role of motivational resources in predicting changes in achievement and school well-being beyond intelligence. *Contemporary Educational Psychology*. <https://doi.org/10.1016/j.cedpsych.2020.101905>
- Burton, K. D., Lydon, J. E., D'Alessandro, D. U., & Koestner, R. (2006). The differential effects of intrinsic and identified motivation on well-being and performance: Prospective, experimental, and implicit approaches to self-determination theory. *Journal of Personality and Social Psychology*, 91(4), 750–762. <https://doi.org/10.1037/0022-3514.91.4.750>
- Capolongo, S. (2014). Architecture as a generator of health and well-being. *Journal of Public Health Research*, 3, 53. <https://doi.org/10.4081/jphr.2014.276>
- Deci, E. L., & Ryan, R. M. (2000). The “What” and “Why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11, 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Diener, E., & Lucas, R. E. (1999). Personality and subjective well-being. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundation of hedonic psychology* (pp. 213–229). Russell Sage Found.
- Dinisman, T., Fernandes, L., & Main, G. (2015). Findings from the first wave of the ISCWeB project: International perspectives on child subjective well-being. *Child Indicators Research*, 8(1), 1–4. <https://doi.org/10.1007/s12187-015-9305-7>
- Hascher, T., & Hagenauer, G. (2018). Die Bedeutung von Qualitätsfaktoren des Unterrichts und Lernemotionen für das Wohlbefinden in der Schule [The significance of instructional quality factors and learning emotions for well-being in school]. In G. Hagenauer & T. Hascher (Hrsg.), *Emotionen und Emotionsregulation in Schule und Hochschule* (S. 103–119). Waxmann.
- Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist*, 41, 111–127. https://doi.org/10.1207/s15326985Sep4102_4
- Hope, N. H., Holding, A. C., Verner-Filion, J., Sheldon, K. M., & Koestner, R. (2019). The path from intrinsic aspirations to subjective well-being is mediated by changes in basic psychological need satisfaction and autonomous motivation: A large prospective test. *Motivation and Emotion*, 43, 232–241. <https://doi.org/10.1007/s11031-018-9733-z>
- Kanonire, T., Federiakin, D. A., & Uglanova, I. L. (2020). Multicomponent framework for students' subjective well-being in elementary school. *School Psychology*, 35(5), 321–331. <https://doi.org/10.1037/spq0000397>
- Kawabata, M., Yamazaki, F., Guo, D. W., & Chatzisarantis, N. L. D. (2017). Advancement of the Subjective Vitality Scale: Examination of alternative measurement models for Japanese and Singaporeans. *Scandinavian Journal of Medicine & Science in Sports*, 27, 1793–1800. <https://doi.org/10.1111/sms.12760>
- Kleinkorres, R., Stang, J., & McElvany, N. (2020). A longitudinal analysis of reciprocal relations between students' well-being and academic achievement. *Journal for Educational Research Online*, 12(2), 114–165.
- León, J., & Núñez, J. L. (2013). Causal ordering of basic psychological needs and well-being. *Social Indicators Research*, 114(2), 243–253. <https://doi.org/10.1007/s11205-012-0143-4>
- Marsh, H. W., Trautwein, U., Lüdtke, O., & Köller, O. (2006). Integration of multidimensional self-concept and core personality constructs: Construct validation and relations to well-being and achievement. *Journal of Personality*, 74, 403–456. <https://doi.org/10.1111/j.1467-6494.2005.00380.x>
- Martinek, D., Carmignola, M., Müller, F. H., Bieg, S., Thomas, A., Eckes, A., Großmann, N., Dittrich, A.-K., & Wilde, M. (2021). How can students feel more vital amidst severe restrictions? Psychological needs satisfaction, motivational regulation and vitality of students during the coronavirus pandemic restrictions. *European Journal of Investigation in Health, Psychology and Education*, 11(2), 405–422. <https://doi.org/10.3390/ejihpe11020030>
- Milyavskaya, M., & Koestner, R. (2011). Psychological needs, motivation, and well-being: A test of self-determination theory across multiple domains. *Personality and Individual Differences*, 50(3), 387–391. <https://doi.org/10.1016/j.paid.2010.10.029>
- Petermans, A., & Pohlmeier, A. E. (2014). Design for subjective well-being in interior architecture. In *Proceedings of the annual architectural research symposium in Finland* (pp. 206–218). <https://journal.fi/atut/article/view/45378>
- R Core Team. (2021). *R: A language and environment for statistical computing*. Vienna, Austria. Retrieved from <https://www.R-project.org/>
- Reinders, H. (2006). Kausalanalysen in der Längsschnittforschung. Das Crossed-Lagged-Panel Design [Causal analysis through longitudinal research. The cross-lagged-panel-design.]. *Diskurs Kindheits- Und Jugendforschung*, 1(4), 569–587.
- Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: The role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin*, 26(4), 419–435. <https://doi.org/10.1177/0146167200266002>
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52, 141–166. <https://doi.org/10.1146/annurev.psych.52.1.141>
- Ryan, R. M., & Deci, E. L. (2009). Promoting self-determined school engagement: Motivation, learning, and well-being. In K. R. Wenzel & A. Wigfield (Eds.), *Educational psychology handbook series Handbook of motivation at school* (pp. 171–195). Routledge/Taylor & Francis Group.

- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Publishing.
- Ryan, R., & Deci, E. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Ryan, R. M., Deci, E. L., & Grolnick, W. S. (1995). Autonomy, relatedness, and the self: Their relation to development and psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Wiley series on personality processes. Developmental psychopathology, Vol. 1 Theory and methods* (pp. 618–655). Wiley.
- Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality*, 65, 529–565. <https://doi.org/10.1111/j.1467-6494.1997.tb00326.x>
- Ryan, R. M., Sheldon, K., Kasser, T., & Deci, E. L. (1996). All goals are not created equal: An organismic perspective on the nature of goals and their regulation. In P. M. Gollwitzer & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behavior* (pp. 7–26). Guilford Press.
- Schwarz-Mette, R. A., Shankman, J., Dueweke, A. R., Borowski, S., & Rose, A. J. (2020). Relations of friendship experiences with depressive symptoms and loneliness in childhood and adolescence: A meta-analytic review. *Psychological Bulletin*, 146, 664–700. <https://doi.org/10.1037/bul0000239>
- Sheldon, K. M., & Kasser, T. (1998). Pursuing personal goals: Skills enable progress, but not all progress is beneficial. *Personality and Social Psychology Bulletin*, 24, 1319–1331. <https://doi.org/10.1177/01461672982412006>
- Sheldon, K. M., Ryan, R. M., & Reis, H. T. (1996). What makes for a good day? Competence and autonomy in the day and in the person. *Personality and Social Psychology Bulletin*, 22, 1270–1279. <https://doi.org/10.1177/01461672962212007>
- Virtanen, T., Vasalampi, K., Torppa, M., Lerkkanen, M.-K., & Nurmi, J.-E. (2019). Changes in students' psychological well-being during transition from primary school to lower secondary school: A person-centered approach. *Learning and Individual Differences*, 69, 138–149. <https://doi.org/10.1016/j.lindif.2018.12.001>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.