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ARTICLES

Measuring students' coping with the Brief COPE: An investigation testing different factor structures across two contexts of university education

Fabian Pels, Alina Schäfer-Pels, and Birte von Haaren-Mack

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Measuring students' coping with the Brief COPE: An investigation testing different factor structures across two contexts of university education

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Abstract: Appropriate instruments are required for professionals in the field of educational psychology to measure students' strategies to cope with stress. As the results of previous studies are inconsistent, the purpose of the present manuscript was to examine the factor structure of the situational version of the Brief COPE as an economic and flexible coping measure to be used in the domain of university education and health psychology. In a sample of 508 university students, three factor structures were compared across two contexts of university education. Results show that a hierarchical two-level factor structure fits the data best, with relatively stable coping dimensions at superordinate levels and a variety of specific strategies and acts at subordinate levels. The findings support the applicability of the situational version of the Brief COPE in research and non-clinical practice.

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I. Introduction

Coping in students is an issue of great concern. This is particularly true in light of survey results which indicate that university students in a number of different countries suffer from stress[1,2,3,4] caused by a multitude of stressors.[5] Although stress can have positive consequences (e.g., personal growth[6,7]), it is more often linked to a wide range of negative health (e.g., high blood pressure, anxiety, depression or academic burnout[8,9]), learning (e.g., drop in learning performance[10]) or behavior (e.g., drop out[11]) outcomes. Thus, stress

[1] Nuran Bayram and Nazan Bilgel, "The Prevalence and Socio-Demographic Correlations of Depression, Anxiety and Stress Among a Group of University Students," *Social Psychiatry and Psychiatric Epidemiology* 43, no. 8 (2008): 668–70, https://doi.org/10.1007/s00127-008-0345-x.

[2] Uta Herbst, Markus Voeth, Anne Theresa Eidhoff, Mareike Müller, and Sarah Stief, "Studierendenstress in Deutschland: Eine empirische Untersuchung" (Student stress in Germany: an empirical study) (Berlin: AOK, 2016), 21–24.

[3] Wendy Larcombe et al., "Prevalence and Socio-Demographic Correlates of Psychological Distress Among Students at an Australian University," *Studies in Higher Education* 41, no. 6 (2014): 1080, https://doi.org/10.1080/03075079.2014.966072.

[4] Josephine G. W. S. Wong et al., "Web-Based Survey of Depression, Anxiety and Stress in First-Year Tertiary Education Students in Hong Kong," *The Australian and New Zealand Journal of Psychiatry* 40, no. 9 (2006): 778, https://doi.org/10.1111/j.1440-1614.2006.01883.x.

[5] Yao-Ting Sung and Tzu-Yang Chao, "Construction of the Examination Stress Scale for Adolescent Students," *Measurement and Evaluation in Counseling and Development* 48, no. 1 (2015): 50–53, https://doi.org/10.1177/0748175614538062.

[6] Iva Solcova and Peter Tavel, "Stress-Related Growth in Two Challenging Conditions," *Journal of Human Performance in Extreme Environments* 13, no. 1 (2017): 5, https://doi.org/10.7771/2327-2937.1099.

[7] Allison A. Vaughn, Scott C. Roesch, and Arianna A. Aldridge, "Stress-Related Growth in Racial/ethnic Minority Adolescents," *Educational and Psychological Measurement* 69, no. 1 (2009): 137, https://doi.org/10.1177/0013164408318775.

[8] Sheena Johnson, "The Experience of Work-Related Stress Across Occupations," *Journal of Managerial Psychology* 20, no. 2 (2005): 182–83, https://doi.org/10.1108/02683940510579803.

[9] George M. Slavich, "Life Stress and Health: A Review of Conceptual Issues and Recent Findings," *Teaching of Psychology* 43, no. 4 (2016): 348–51, https://doi.org/10.1177/0098628316662768.

[10] Jeffrey A. LePine, Marcie A. LePine, and Christine L. Jackson, "Challenge and Hindrance Stress: Relationships with Exhaustion, Motivation to Learn, and Learning Performance," *Journal of Applied Psychology* 89, no. 5 (2004): 888, https://doi.org/10.1037/0021-9010.89.5.883.

[11] Simon Brooman and Sue Darwent, "'Yes, as the Articles Suggest, I Have Considered Dropping Out': Self-Awareness Literature and the First-Year Student," *Studies in Higher Education* 37, no. 1 (2012): 26–31, https://doi.org/10.1080/03075079.2010.490580.

in students requires coping.[12] This, in turn, strengthens the need for appropriate instruments to measure coping both for research (e.g., to identify adaptive coping strategies) and applied (e.g., as part of the assessment phase of a stress reduction intervention) purposes.

The development of instruments to measure coping is a work that originated in the field of stress and emotion research in the early 1980s[13] and was continued and used by Educational Psychology.[14] Consequently, many instruments were developed in or applied to the domain of education. However, (1) these instruments often comprise a multitude of items, such as the Ways of Coping Questionnaire,[15,16] and are thus time-consuming and inefficient. Moreover, (2) these instruments are often too specific (e.g., because they deal with specific coping for improving education; the Coping Resources Inventory Scales for Educational Enhancement[17]) or (3) have an application that is too broad and does not apply exclusively to the education domain (e.g., because they deal with critical life events in general; the Life Situations Inventory[18]). Given these problems with existing coping questionnaires in the education domain, the purpose of the present manuscript is to further examine the Brief COPE[19] as an economic and flexible measure of coping for use in the field of (university) education.

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[12] Eilidh Cage et al., "Barriers to Accessing Support for Mental Health Issues at University," *Studies in Higher Education* 39, no. 1 (2018): 3–4, https://doi.org/10.1080/03075079.2018.1544237.

[13] Richard S. Lazarus and Susan Folkman, *Stress, Appraisal, and Coping* (New York: Springer, 1984), 117–40.

[14] Janet L. Kottke, Gloria Cowan, and Diane J. Pfahler, "Development of Two Scales of Coping Strategies: An Initial Investigation," *Educational and Psychological Measurement* 48, no. 3 (1988): 737–42, https://doi.org/10.1177/0013164488483022.

[15] Susan Folkman and Richard S. Lazarus, *Manual for the Ways of Coping Scale* (Palo Alto, CA: Consulting Psychology Press, 1988), 1–40.

[16] Kathryn R. Rexrode, Suni Petersen, and Siobhan O'Toole, "The Ways of Coping Scale: A Reliability Generalization Study," *Educational and Psychological Measurement* 68, no. 2 (2008): 262–80, https://doi.org/10.1177/0013164407310128.

[17] Christopher J. McCarthy et al., "Factor Analysis of the Coping Resources Inventory Scales for Educational Enhancement," *Measurement and Evaluation in Counseling and Development* 32, no. 4 (2019): 199–215, https://doi.org/10.1080/07481756.2000.12068987.

[18] H. Feifel and S. Strack, "Coping with Conflict Situations: Middle-Aged and Elderly Men," *Psychology and Aging* 4, no. 1 (1989): 29–30.

[19] Charles S. Carver, "You Want to Measure Coping but Your Protocol's Too Long: Consider the Brief COPE," *International Journal of Behavioral Medicine* 4, no. 1 (1997): 92–100, https://doi.org/10.1207/s15327558ijbm0401_6.

I.1. Coping

Coping with stress can be defined as "efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person".[20] When an individual appraises external (e.g., expectations from others) and/or internal (e.g., individual goals) demands that exceed his or her own resources (e.g., self-efficacy), the demands become stressors. A stressor is a stimulus that causes a stressful behavioral or physiological response.[21] In order to cope with stress, individuals make efforts to manage the external and/or internal demands (i.e., the stressors) in the form of cognitive, emotional and behavioral coping strategies.[22]

An individual's use of coping strategies is dynamic in nature.[23] This dynamic can be characterized as an ongoing process in which the use of coping strategies changes as stressors and appraisals change. Stressors and appraisals are neither stable across contexts nor over time. Consequently, the respective coping reactions can change across contexts and over time.[24,25] Hence, actual coping behavior cannot be described as a stable personality trait.[26]

In recent years, numerous attempts have been made to categorize coping strategies.[27,28] For instance, the differentiation of coping strategies into problem-focused and emotion-focused coping dimensions.[29,30]

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[20] Lazarus and Folkman, *Stress*, 141.

[21] Lazarus and Folkman, *Stress*, 15.

[22] Shelley E. Taylor and Annette L. Stanton, "Coping Resources, Coping Processes, and Mental Health," *Annual Review of Clinical Psychology* 3, no. 1 (2007): 378–90, https://doi.org/10.1146/annurev.clinpsy.3.022806.091520.

[23] Lazarus and Folkman, *Stress*, 118–21.

[24] Denise de Ridder, "What Is Wrong with Coping Assessment? A Review of Conceptual and Methodological Issues," *Psychology & Health* 12, no. 3 (1997): 418–27, https://doi.org/10.1080/08870449708406717.

[25] François Vandercleyen et al., "Pre-Service Teachers in PE Involved in an Organizational Critical Incident: Emotions, Appraisal and Coping Strategies," *Physical Education and Sport Pedagogy* 19, no. 2 (2014): 168–73, https://doi.org/10.1080/17408989.2012.732564.

[26] Vandercleyen et al., "Pre-Service Teachers", 173.

[27] Katharine H. Greenaway et al., "Measures of Coping for Psychological Well-Being," in *Measures of Personality and Social Psychological Constructs*, ed. Gregory J. Boyle, Donald H. Saklofske and Gerald Matthews (London: Academic Press, 2015), 108–09.

[28] Ralf Schwarzer and Christine Schwarzer, "A Critical Survey of Coping Instruments," in *Handbook of Coping: Theory, Research, Applications*, ed. Moshe Zeidner and Norman S. Endler (Oxford: John Wiley & Sons, 1996), 2–3.

[29] Wilfried F. Admiraal, Fred A. Korthagen, and Theo Wubbels, "Effects of Student Teachers' Coping Behaviour," *British Journal of Educational Psychology* 70, no. 1 (2000): 35, https://doi.org/10.1348/000709900157958.

[30] Charles S. Carver and Sara Vargas, "Stress, Coping, and Health," in *The Oxford Handbook of Health Psychology*, ed. Howard S. Friedman (Oxford University Press, 2011), 163–65.

Problem-focused coping strategies are supposed to manage a critical stressor by problem solving and identifying and evaluating potential alternatives to momentary behavior.[31] Emotion-focused coping strategies are supposed to concentrate on regulating the emotional response to stressors. Emotion-focused coping strategies are applied when an individual appraises a stressor as unchangeable or largely uncontrollable.[32,33] Furthermore, coping strategies can be classified into adaptive and maladaptive coping dimensions, for example. Adaptive strategies are said to be more functional than maladaptive strategies because they contribute to the sustainable management of stressors in the long term. In general, the literature classifies problem-focused and support-seeking strategies as adaptive and emotion-focused strategies as well as strategies such as avoidance and escape as maladaptive.[34] All of these attempts to categorize coping strategies have influenced the development of factor structures in coping questionnaires such as the Brief COPE.[35]

I.2. The Brief COPE

The Brief COPE[36] questionnaire was adapted from the COPE inventory.[37] It aims to facilitate the investigation of coping in naturally occurring settings by measuring coping responses in an economical way (i.e., time- and cost-efficient). It is a self-report instrument designed to assess situational or dispositional coping. As such, the Brief COPE overcomes problems relating to economics, context specificity and flexibility that are inherent to other coping instruments in the field of (university) education.

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[31] Alexander-Stamatios Antoniou, Aikaterini Ploumpi, and Marina Ntalla, "Occupational Stress and Professional Burnout in Teachers of Primary and Secondary Education: The Role of Coping Strategies," *Psychology* 4, 3A (2013): 350, https://doi.org/10.4236/psych.2013.43A051.

[32] Admiraal, Korthagen and Wubbels, "Effects," 43–47.

[33] E. Stephenson, D. B. King, and A. DeLongis, "Coping Process," in *Stress: Concepts, Cognition, Emotion, and Behavior*, ed. George Fink (London, UK: Academic Press, 2016), 362.

[34] Ellen Skinner and Jeffry Beers, "Mindfulness and Teachers' Coping in the Classroom: A Developmental Model of Teacher Stress, Coping, and Everyday Resilience," in *Handbook of Mindfulness in Education*, ed. Kimberly A. Schonert-Reichl and Robert W. Roesner (New York, NY: Springer New York, 2016), 100–01.

[35] Carver, "Measure Coping," 92–100.

[36] Carver, "Measure Coping," 92–100.

[37] Charles S. Carver, M. F. Scheier, and J. K. Weintraub, "Assessing Coping Strategies: A Theoretically Based Approach," *Journal of Personality and Social Psychology* 56, no. 2 (1989): 267–83.

The original Brief COPE questionnaire consists of 48 items which are assigned to 14 theoretically and exploratory empirically driven factors. Each factor comprises two Likert-type scale items ranging from 1 ("I haven't been doing this at all") to 4 ("I've been doing this a lot"). The two items per factor were selected by Carver[38] on a criteria-driven basis from the comprehensive COPE inventory.[39] These are items that, first, had a high loading on the respective factor of the COPE inventory and, second, have demonstrated their value over years of field use due to their clarity. Two items per factor are, therefore, considered by Carver[40] to be sufficient for a brief questionnaire.

The factors are active coping (e.g., "I've been taking action to try to make the situation better"), planning (e.g., "I've been thinking hard about what steps to take"), positive reframing (e.g., "I've been looking for something good in what is happening"), acceptance (e.g., "I've been learning to live with it"), humor (e.g., "I've been making jokes about it"), religion (e.g., "I've been praying or meditating"), using emotional support (e.g., "I've been getting emotional support from others"), using instrumental support (e.g., "I've been getting help and advice from other people"), self-distraction (e.g., "I've been turning to work or other activities to take my mind off things"), denial (e.g., "I've been refusing to believe that it has happened"), venting (e.g., "I've been expressing my negative feelings"), substance use (e.g., "I've been using alcohol or other drugs to help me get through it"), behavioral disengagement (e.g., "I've been giving up the attempt to cope"), and self-blame (e.g., "I've been criticizing myself").

However, a number of reviews[41,42,43] have identified inconsistencies in the factor structure of the Brief COPE. Firstly, studies differ in whether they consider (a) a one-level factor structure (for an example, see Fig. 1) or (b) a hierarchical two-level factor structure (for an example, see Fig.

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[38] Carver, "Measure Coping," 94.

[39] Carver, Scheier, and Weintraub, "Assessing Coping Strategies," 267–83.

[40] Carver, "Measure Coping," 94–95.

[41] Sarah V. Brasileiro et al., "Controversies Regarding the Psychometric Properties of the Brief COPE: The Case of the Brazilian-Portuguese Version "COPE Breve"," *PLOS ONE* 11, no. 3 (2016): 1–14, https://doi.org/10.1371/journal.pone.0152233.

[42] Christian U. Krägeloh, "A Systematic Review of Studies Using the Brief COPE: Religious Coping in Factor Analyses," *Religions* 2, no. 4 (2011): 216–46, https://doi.org/10.3390/rel2030216.

[43] Dario Monzani et al., "The Situational Version of the Brief COPE: Dimensionality and Relationships with Goal-Related Variables," *Europe's Journal of Psychology* 11, no. 2 (2015): 295–310, https://doi.org/10.5964/ejop.v11i2.935.

2-3). In (b) a hierarchical two-level factor structure, first-level factors are nested within second-level factors (i.e., second-level factors comprise first-level factors). Secondly, studies differ in (a) whether they empirically examine the factor structure of the Brief COPE[44,45] or (b) whether instead they rely on a factor structure drawn from previous theoretical considerations or research findings without empirical testing.[46] Of those studies that empirically examine the factor structure, most consider a one-level factor structure. However, these studies differ widely in the number of factors they statistically identify (between two and 14 factors per analysis; for an overview, see [47] and [48]). Furthermore, few factor solutions reflect the factors outlined by Carver.[49] Very few studies consider a two-level factor structure. Knoll and colleagues[50] found four second-level factors (focus on positive, support coping, active coping, evasive coping), which comprise eleven of the 14 original first-level factors. In general, inconsistencies in factor structures are common in recent studies on coping instruments.[51,52]

Given the benefits of the Brief COPE on the one hand (i.e., economics, context specificity and flexibility) and the inconsistencies regarding the factor structure on the other hand, it is necessary to further investigate and overcome these inconsistencies. Regarding the Brief COPE, at least three superordinate issues can be highlighted that may be responsible for the inconsistencies. These issues are – at least to some extent – linked to each other.

The first issue that may account for the inconsistencies in factor structure is related to the lack of *theoretical foundation* underpinning previous Brief

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[44] Julie Doron et al., "Coping Profiles, Perceived Stress and Health-Related Behaviors: A Cluster Analysis Approach," *Health Promotion International* 30, no. 1 (2014): 92, https://doi.org/10.1093/heapro/dau090.

[45] Yasuo Miyazaki et al., "Factorial Structure of Brief COPE for International Students Attending U.S. Colleges," *College Student Journal* 42, no. 3 (2008): 3.

[46] Matthias Michal et al., "Prevalence and Correlates of Depersonalization in Students Aged 12-18 Years in Germany," *Social Psychiatry and Psychiatric Epidemiology* 50, no. 6 (2015): 997–98, https://doi.org/10.1007/s00127-014-0957-2.

[47] Brasileiro et al., "Controversies," 1–14.

[48] Krägeloh, "A Systematic Review," 216–46.

[49] Carver, "Measure Coping," 96.

[50] Nina Knoll, Nina Rieckmann, and Ralf Schwarzer, "Coping as a Mediator Between Personality and Stress Outcomes: A Longitudinal Study with Cataract Surgery Patients," *European Journal of Personality* 19, no. 3 (2005): 233, https://doi.org/10.1002/per.546.

[51] Stephen W. Cook and P. P. Heppner, "A Psychometric Study of Three Coping Measures," *Educational and Psychological Measurement* 57, no. 6 (1997): 918, https://doi.org/10.1177/0013164497057006002.

[52] De Ridder, „What is wrong," 419.

COPE factor structures. In general, theories can serve as a foundation for reducing the dimensionality of psychological constructs by taking into account, for example, the psychological components (e.g., behavior, cognition, affect), functions, or consequences of a construct. In terms of coping, Schwarzer and Schwarzer[53] highlight that dimensionality reduction can be achieved by theoretically grouping coping strategies according to their purpose, meaning or functional value. In recent Brief COPE studies, factor solutions have often been derived only from exploratory factor analyses and, thus, are solely based on statistical criteria. This leads to statistical random findings and neglects the strengths of theoretical foundations. The lack of theoretical consideration and a priori grouping of coping strategies into dimensions could have prevented the identification of the most appropriate factor solutions across Brief COPE studies. In conclusion, there is a need for investigations considering theoretical foundations in factor structure analyses.

The second issue that may account for the inconsistencies in factor structure concerns the *context*[54] in which the Brief COPE has been used. Studies differ in what they examine and, consequently, in the context to which the items of the Brief COPE relate. Some studies use the so-called dispositional version of the Brief COPE and, thus, assess coping in general (i.e., global coping[55,56,57,58]), while others use the so-called situational version, thus, assessing coping in specific situations or domains. The situational version, for example, has been used to assess coping in the field

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[53] Schwarzer and Schwarzer, „A critical survey," 108–09.

[54] Robert J. Vallerand, "Toward a Hierarchical Model of Intrinsic and Extrinsic Motivation," in *Advances in Experimental Social Psychology*, ed. M. P. Zanna (San Diego: Academic Press, 1997), 274.

[55] Anja Achtziger and Ute C. Bayer, "Self-Control Mediates the Link Between Perfectionism and Stress," *Motivation and Emotion* 37, no. 3 (2013): 413–23, https://doi.org/10.1007/s11031-012-9321-6.

[56] Anne Ahnis et al., "Surgically and Conservatively Treated Obese Patients Differ in Psychological Factors, Regardless of Body Mass Index or Obesity-Related Co-Morbidities: A Comparison Between Groups and an Analysis of Predictors," *PLOS ONE* 10, no. 2 (2015): 1–16, https://doi.org/10.1371/journal.pone.0117460.

[57] Michal, Matthias, Eva Duven, Sebastian Giralt, Michael Dreier, Kai W. Muller, Julia Adler, Manfred E. Beutel, and Klaus Wolfling. "Prevalence and Correlates of Depersonalization in Students Aged 12-18 Years in Germany." *Social Psychiatry and Psychiatric Epidemiology* 50, no. 6 (2015): 995–1003. https://doi.org/10.1007/s00127-014-0957-2.

[58] Beatriz Rueda and Esperanza Valls, "Is the Effect of Psychological Inflexibility on Symptoms and Quality of Life Mediated by Coping Strategies in Patients with Mental Disorders?," *International Journal of Cognitive Therapy* 13, no. 2 (2020): 112–26, https://doi.org/10.1007/s41811-020-00069-4.

of education[59,60,61] as well as to assess coping with specific physical[62,63,64] or mental disorders.[65,66] Early on, de Ridder[67] stated that a dispositional approach reduces the complexity of measuring coping. However, this perspective neglects that an individual's use of coping can vary between different types of stressful situations (i.e., the stressor and the related appraisal[68]). Moreover, it neglects that certain coping strategies are bound by situational circumstances. The latter may be the reason why in some situations a specific factor structure is unlikely to be found or replicated: If all participants mark "1" ("I haven't been doing this at all") for several items because the corresponding coping strategies cannot be applied to a situation, a floor effect with no variance will occur, making it difficult to find or replicate a specific factor structure. To conclude, future investigations should examine the same factor structures across different contexts.

The third issue that may account for the inconsistencies in the factor structure concerns the *methodological characteristics* of the studies that have used the Brief COPE. In this regard, authors most commonly raise translation-related and statistic-related points of criticism. In terms of translations,

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[59] Kathryn Gow et al., "Retention and Intentions to Quit Among Australian Male Apprentices," *Education + Training* 50, no. 3 (2008): 216–30, https://doi.org/10.1108/00400910810873991.

[60] Yasuo Miyazaki, Nancy Bodenhorn, Carlos Zalaquett, and Kok-Mun Ng. "Factorial Structure of Brief COPE for International Students Attending U.S. Colleges." *College Student Journal* 42, no. 3 (2008): 795–806.

[61] Muhamad S. B. Yusoff, "The Validity of the Malay Brief Cope in Identifying Coping Strategies Among Adolescents in Secondary School," *International Medical Journal* 18, no. 1 (2011): 29–33.

[62] Robert J. Cramer et al., "The Brief COPE: Factor Structure and Associations with Self- and Other-Directed Aggression Among Emerging Adults," *Evaluation & the Health Professions* 43, no. 2 (2020): 120–30, https://doi.org/10.1177/0163278719873698.

[63] Nina Knoll et al., "Predictors of Spouses' Provided Support for Patients Receiving Laparoscopic Radical Prostatectomy Peri-Surgery," *Psycho-Oncology* 16, no. 4 (2007): 312–19, https://doi.org/10.1002/pon.1061.

[64] Aleksandra Luszczynska et al., "Patients' Coping Profiles and Partners' Support Provision," *Psychology & Health* 22, no. 7 (2007): 749–64, https://doi.org/10.1080/14768320600976232.

[65] Matthias Brand, Christian Laier, and Kimberly S. Young, "Internet Addiction: Coping Styles, Expectancies, and Treatment Implications," *Frontiers in Psychology* 5 (2014): 1–14, https://doi.org/10.3389/fpsyg.2014.01256.

[66] Olajide B. Obembe et al., "The Relationship Between Coping Styles and Depression Among Caregivers of Children with Cerebral Palsy in Nigeria, West Africa," *Archives of Clinical Psychiatry (São Paulo)* 46, no. 6 (2019): 145–50, https://doi.org/10.1590/0101-60830000000215.

[67] De Ridder, „What Is Wrong," 420.

[68] Schwarzer and Schwarzer, „A Critical Survey," 107–09.

Brasileiro and colleagues[69] criticized the fact that many translated versions of the Brief COPE were not created by using a best-practice approach for cross-cultural adaptation of questionnaire translations. In terms of statistics, both Krägeloh[70] and Monzani and colleagues[71] identify inappropriate techniques within the exploratory factor analyses of many recent studies (e.g., small and homogeneous samples, inappropriate scaling of the Brief COPE). They emphasize the need for confirmatory factor analyses as a more robust statistical procedure for the Brief COPE.

I.3. Study aim

There are three issues that may account for the inconsistencies in the Brief COPE factor structure. With these issues and the related conclusions in mind, the aim of the present study is to empirically analyze different factor structures of the Brief COPE.[72] This will help to define an appropriate instrument to assess coping in students for both research and practical application. More specifically, the study targets the three aforementioned issues and the related conclusions by (1) considering *theoretical foundations* of factor structures, (2) examining factor structures in *two contexts* of university education each and (3) applying an *appropriate methodological procedure*.

In terms of (1) the *theoretical foundations* of factor structures, three models will be examined: Firstly, the *original Brief COPE factor structure* (see Fig. 1) by Carver[73] with the aforementioned 14 first-level factors (i.e., active coping, planning, positive reframing, acceptance, humor, religion, using emotional support, using instrumental support, self-distraction, denial, venting, substance use, behavioral disengagement, self-blame) will be tested. According to Carver[74], this factor structure reflects 14 conceptually different coping reactions derived from previous theoretical and exploratory empirical analyses of the original COPE inventory.[75]

Secondly, a hierarchical factor structure with 14 first-level factors and three second-level factors will be tested which takes into account the *functional value of coping strategies* (see Fig. 2). This factor structure

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[69] Brasileiro et al., "Controversies," 2.
[70] Krägeloh, "A Systematic Review," 2.
[71] Monzani, et al., "The Situational Version," 298–99.
[72] Carver, "Measure Coping," 92–100.
[73] Carver, "Measure Coping," 96.
[74] Carver, "Measure Coping," 92–94.
[75] Carver, Scheier, and Weintraub, "Assessing Coping Strategies," 267–83.

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consists of the aforementioned 14 conceptually different coping reactions on the first level and problem-focused coping, emotion-focused coping and less-useful coping strategies on the second level. These second-level factors represent a theoretical distinction between the evaluation of coping strategies as functional (comprising problem-focused coping and emotion-focused coping) on the one hand and potentially dysfunctional (i.e., less useful) on the other hand. This theoretical distinction is based on the considerations of Carver and colleagues[76] regarding the COPE inventory, who assume that coping strategies have a different functional value while still reflecting Lazarus and Folkman's[77] distinction between problem-focused and emotion-focused coping.

Thirdly, a factor structure with eleven first-level factors and four second-level factors that takes into account the *purpose of coping strategies* (see Fig. 3) will be tested. The purpose is typically also considered a criterion for grouping coping strategies.[78] This factor structure consists of eleven of the aforementioned 14 conceptually different coping reactions on the first level and focus on positive, support coping, active coping and evasive coping on the second level. Three first-level factors (self-distraction, substance use, behavioral disengagement) were removed and not assigned to any of the second-level factors. This factor structure represents a theoretical and empirical distinction between superordinate purposes of coping strategies as suggested by Knoll[79] and Knoll and colleagues.[80] This group of authors explicitly avoided an evaluative labeling of specific coping strategies as either functional or dysfunctional (see[81]).

In terms of (2) *contexts*, these three factor structures will be examined in two different contexts within the field of university education. More specifically, they will be examined with regard to students' coping during university lessons (e.g., during lectures, seminars) and with regard to students' study-related coping outside of university lessons (e.g., while preparing presentations or exams). There are two reasons for this approach: Firstly, it is important to distinguish between these contexts both in future research and in practical application. The results of future investigations that distinguish between these contexts will enable universities or practitioners to

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[76] Carver, Scheier, and Weintraub, "Assessing Coping Strategies," 268–69.

[77] Lazarus and Folkman, *Stress,* 148–54.

[78] Schwarzer and Schwarzer, „A Critical Survey," 108–09.

[79] Nina Knoll "Coping as a Personality Process: How Elderly Patients Deal with Cataract Surgery." (PhD diss., Freie Universität Berlin, 2002), 80.

[80] Knoll, Rieckmann, Schwarzer „Coping As A Mediator," 233–34.

[81] Knoll, "Coping As Personality Process," 80.

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provide students with coping strategies relating to their studies both outside of university lessons (e.g., to help deal with their workload) and during university lessons (e.g., to deal with exam anxiety or public speaking). The second reason for this approach is that the present study aims to explore whether the factor structures can be replicated (i.e., show invariance of factor structures) in two similar but different contexts of the same domain. Irrespective of a variance or invariance in factor structures, it is assumed that individuals (i.e., students) will differ in their application of coping strategies between the two contexts, since an individual's use of coping strategies is dynamic in nature.[82]

In terms of (3) an *appropriate methodological procedure*, confirmatory factor analyses will be conducted to analyze the data as recommended for theoretical factor considerations and for the scaling of the Brief COPE.[83]

To summarize, the overall purpose of this manuscript is to further examine the Brief COPE[84] as an economic and flexible measure of coping to be used in the field of (university) education. With this in mind, the specific aim of the present study is to empirically analyze different factor structures of the Brief COPE[85] in order to determine which of the three factor structures (model 1: 14 first-level factors; model 2: 14 first-level factors and three second-level factors; model 3: eleven first-level factors and four second-level factors; see Fig. 1) is best suited for the assessment of coping in two contexts of university education (during university lessons and outside of university lessons). This will be realized on the basis of the existing German language translation[86,87] of the situational version of the Brief COPE.

II. Method

II.1. Sample

After deleting multivariate outliers, the original sample of 547 participants was reduced to a final sample of 508 German university students (40.2% female, 59.8% male) ranging from 18 to 41 years of age (M = 21.09, SD = 2.72). Participants were either sport science or physical education students attending a sport university in North-Rhine Westphalia, Germany. 84.6% of

[82] Lazarus and Folkman, *Stress,* 148–54.
[83] Krägeloh, "A Systematic Review," 233.
[84] Carver, "Measure Coping," 92–100.
[85] Carver, "Measure Coping," 92–100.
[86] Knoll, "Coping As Personality Process," 299–301.
[87] Knoll, Rieckmann, Schwarzer „Coping As A Mediator," 233–34.

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the participants studied in a Bachelor's degree program (BA) and 15.0% in a Master's degree program (MA). Most students (82.9%) were in the first term of their respective degree program ($M = 1.54$, $SD = 1.61$).

II.2. Measure

Coping was assessed using the situational version of the German-language translation[88,89] of the original Brief COPE.[90] Since the participants were German native speakers, the German version of the Brief COPE was used. This version includes 28 items that are similar to the original items, with a response format ranging from 1 ("I haven't been doing this at all") to 4 ("I've been doing this a lot"). In order to assess coping in two different contexts of university education, participants were asked to respond to each item in terms of coping during lessons and subsequently in terms of study-related coping outside of lessons. As such, participants were presented with two response scales ("during the lessons" and "outside of lessons") ranging from 1 to 4 for each item. Participants were given the following instruction: "Please rate to what extent the following statements reflect your usual thinking and acting when you have been faced with unpleasant or difficult situations during your study program so far. Please indicate, for each of the following statements, how far they were true for your usual thinking and acting during lessons (e.g., lectures, seminars) and outside of lessons (e.g., preparing presentations or exams)."

II.3. Procedure

After approval by the ethics commission and the board of the local university, participants were recruited during regular classes. Participation was on a voluntary basis and withdrawal from participation was possible at any time. Students who agreed to participate were given permission by their lecturer to complete the paper-based questionnaire during their regular classes.

II.4. Data analysis

Data were analyzed using IBM SPSS Statistics 25 and IBM SPSS Amos 25. After screening for multivariate outliers (based on the Mahalanobis

[88] Knoll, "Coping As Personality Process," 299–301.
[89] Knoll, Rieckmann, and Schwarzer, "Coping As A Mediator," 233–34.
[90] Carver, "Measure Coping," 96.

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distance) according to the guidelines of Tabachnick and Fidell[91], the first step in data analysis was to analyze factor structures. Six (three models in two contexts) confirmatory factor analyses (CFAs) based on covariance matrices were computed in order to compare the factor structures and to identify the best of nested models. The results of the three CFAs within each context were compared using the model fit recommendations by Hu and Bentler[92] and the χ^2 difference test. Invariance testing between subgroups (e.g., between BA and MA students) was not carried out because there are no theoretical reasons to assume differences between subgroups (e.g., between sport science and physical education students).

Subsequently, the items were analyzed using descriptive statistics (*M, SD, Min, Max*), multicollinearity analysis (bivariate correlation and tolerance analyses according to Tabachnick and Fidell[93] and Hair et al.[94]), psychometric properties (item discrimination, item homogeneity, internal consistency) and concordance analyses (concordance correlation coefficient; Lin[95]). The concordance analyses were run in order to examine whether the Brief COPE is actually capable of distinguishing intraindividual differences in use of coping strategies across different contexts.

III. Results

III.1. Analysis of factor structures

III.1.1. Model fit

The fit indices for the three factor structures in each context are shown in Table 1. In terms of the "during the lessons" context, model 3 was the only model with an acceptable to good fit across all indices (CMIN/df, TLI, CFI, RMSEA, SRMR; cf. the criteria by Hu and Bentler[96]). The dominance of model 3 was underpinned by χ^2 difference

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[91] Barbara G. Tabachnick and Linda S. Fidell, *Using Multivariate Statistics*, 6. ed., Pearson new internat. ed., Always learning (Harlow: Pearson, 2014), 93–152.

[92] Li-tze Hu and Peter M. Bentler, "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives," *Structural Equation Modeling: A Multidisciplinary Journal* 6, no. 1 (1999): 27–28, https://doi.org/10.1080/10705519909540118.

[93] Tabachnick and Fidell, *Using Multivariate Statistics*, 153–234.

[94] Joseph F. Hair et al., *Multivariate Data Analysis*. Seventh edition, Pearson new international edition. Harlow: Pearson Education Limited, 2014, 161.

[95] Lawrence I-Kuei Lin. "A Concordance Correlation Coefficient to Evaluate Reproducibility." *Biometrics* 45, no. 1 (1989): 255–68. https://doi.org/10.2307/2532051.

[96] Hu and Bentler, "Cutoff Criteria," 27–28.

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tests showing significant differences to model 1 ($\chi^2(67) = 121.31$, $p < .001$) and model 2 ($\chi^2(148) = 401.02$, $p < .001$). Also, the AIC scores of model 3 (493.75) were better than those of model 1 (787.06) and model 2 (904.77). Regarding the "outside of lessons" context, model 1 and model 3 showed acceptable to good fit indices (CMIN/df, TLI, CFI, RMSEA, SRMR). χ^2 difference tests showed a significant difference between model 1 and model 2 ($\chi^2(74) = 305.55$, $p < .001$) and between model 2 and model 3 ($\chi^2(141) = 365.91$, $p < .001$); however, there was no significant difference between model 1 and model 3 ($\chi^2(67) = 60.36$, $p = .704$). Again, also, the AIC scores of model 3 (504.83) were better than those of model 1 (737.19) and model 2 (894.74). Thus, model 3 was the only model with an acceptable to good fit in both contexts and it proved to be superior in comparative analyses.

Table 1

Fit indices for the three factor structures

Context	Model	χ^2	*df*	*p*	CMIN/df	TLI	CFI	RMSEA	SRMR	AIC
"During lessons"	1	493.06	259	< .001	1.90	.85	.90	.05	.05	787.06
	2	772.77	340	< .001	2.27	.79	.81	.05	.06	904.77
	3	371.75	192	< .001	1.94	.89	.91	.05	.05	493.75
"Outside of lessons"	1	443.19	259	< .001	1.71	.91	.94	.04	.04	737.19
	2	748.74	333	< .001	2.25	.84	.86	.05	.06	894.74
	3	382.83	192	< .001	1.99	.91	.92	.05	.05	504.83

III.1.2. Factor loadings

The factor loadings of all models are displayed in Figures 1-3. Results show that, for all models, most factor loadings were acceptable, although some loadings were below the recommended minimum of $\lambda = .60$.[97] Item 2 and item 9 were particularly problematic, with factor loadings below $\lambda = .60$ for all models across both contexts. Additionally, item 1 and item 6 were problematic for model 1 and model 2.

[97] Zainudin Awang. *Research Methodology and Data Analysis*. 2nd ed. Mara: UiTM Press, 2014, 227–54.

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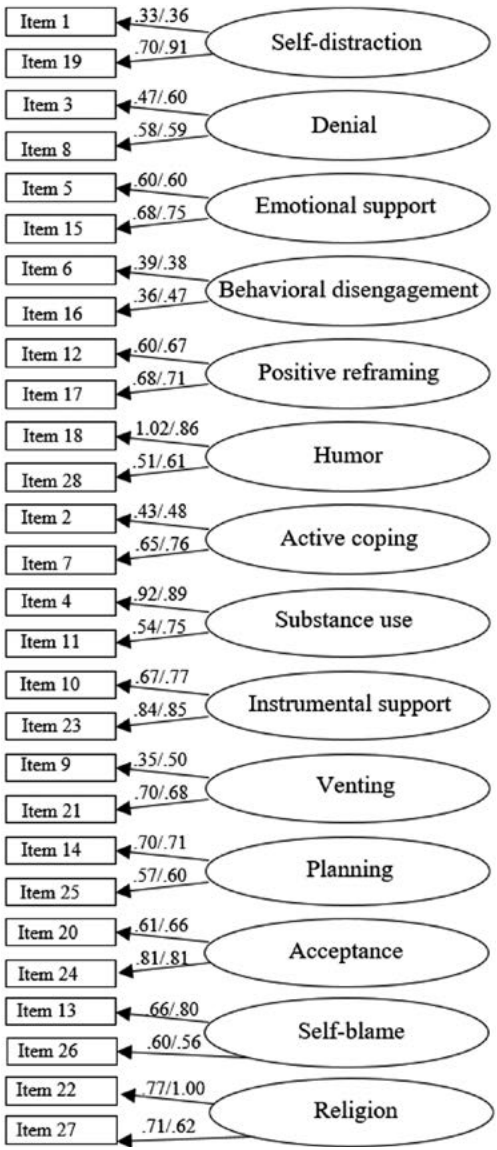

Figure 1

Model 1 (14 first-level factors). Values on the left represent factor loadings for the "during lessons" context, values on the right represent factor loadings for the "outside of lessons" context

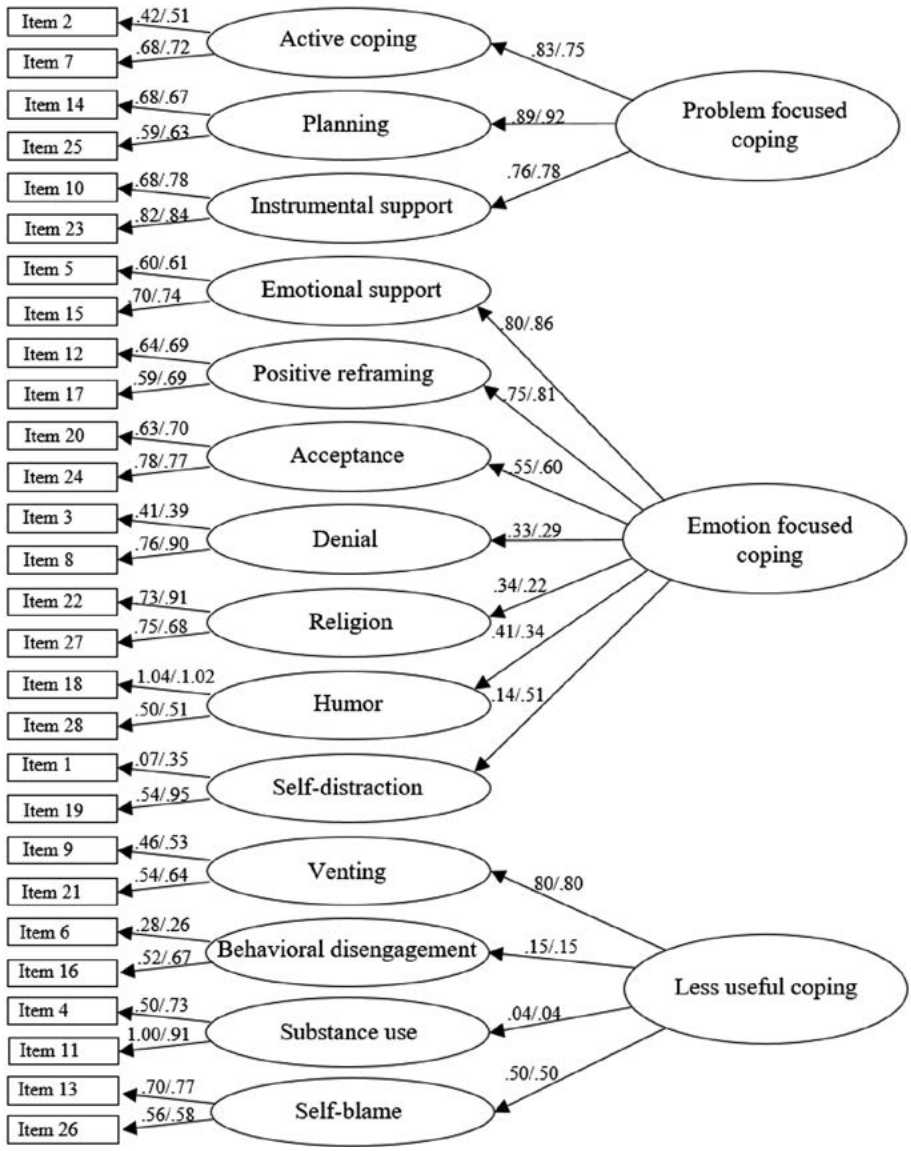

Figure 2

Model 2 (14 first-level factors and three second-level factors). Values on the left represent factor loadings for the "during lessons" context, values on the right represent factor loadings for the "outside of lessons" context

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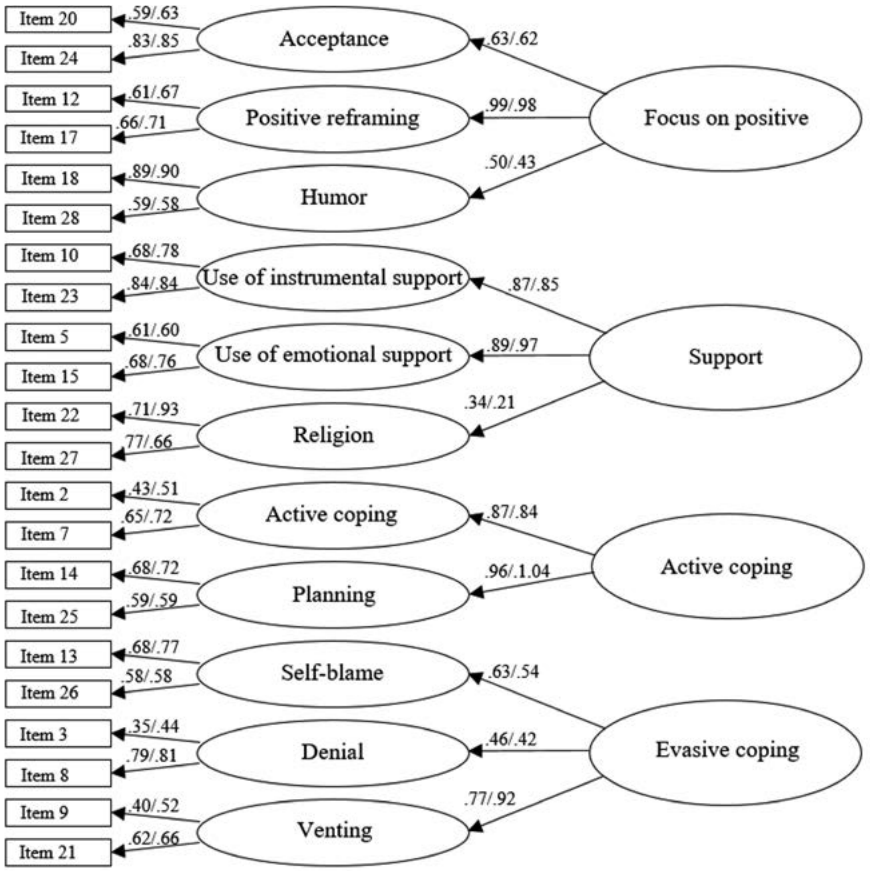

Figure 3

Model 3 (eleven first-level factors and four second-level factors). Values on the left represent factor loadings for the "during lessons" context, values on the right represent factor loadings for the "outside of lessons" context

III.2. Psychometric analyses

III.2.1. Psychometric analyses of items

III.2.1.1. Descriptive item statistics

Descriptive item statistics are displayed in Table 2. For all items and across both contexts, the full range of response options (1 to 4) was used.

Table 2

Descriptive item statistics

Item		Context "During lessons"				Context "Outside of lessons"				Concordance		
No.	Wording I've been…	*M*	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*	ϱ_c	ϱ	C_b
1	… turning to work or other activities to take my mind off things.	1.72	.65	1	4	2.49	0.80	1	4	.15	.23	.63
2	… concentrating my efforts on doing something about the situation I'm in.	1.85	.83	1	4	2.19	0.90	1	4	.05	.15	.34
3	… saying to myself "this isn't real".	1.19	.51	1	4	1.21	0.50	1	4	.02	.09	.22
4	… using alcohol or other drugs to make myself feel better.	1.02	.14	1	4	1.28	0.56	1	4	.07	.19	.37
5	… getting emotional support from others.	2.13	.88	1	4	2.72	0.90	1	4	.98	.98	.99
6	… giving up trying to deal with it.	1.28	.58	1	4	1.32	0.61	1	4	1.00	1.00	1.00
7	… taking action to try to make the situation better.	2.36	.90	1	4	2.63	0.91	1	4	.99	1.00	1.00
8	… refusing to believe that it has happened.	1.32	.59	1	4	1.36	0.61	1	4	1.00	1.00	1.00
9	… saying things to let my unpleasant feelings escape.	1.60	.79	1	4	2.17	0.92	1	4	.98	.99	.99
10	… getting help and advice from other people.	2.01	.85	1	4	2.43	0.93	1	4	.66	.70	.94
11	… using alcohol or other drugs to help me get through it.	1.02	.22	1	4	1.13	0.40	1	4	1.00	1.00	1.00
12	… trying to see it in a different light, to make it seem more positive.	2.57	.89	1	4	2.83	0.86	1	4	.99	.99	1.00
13	… criticizing myself.	1.69	.76	1	4	1.97	0.89	1	4	.99	.99	1.00
14	… trying to come up with a strategy about what to do.	2.44	.95	1	4	2.90	0.90	1	4	.98	.99	1.00

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Item		Context "During lessons"				Context "Outside of lessons"				Concordance		
No.	Wording I've been…	*M*	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*	ϱ_c	ϱ	C_b
15	… getting comfort and understanding from someone.	1.61	.76	1	4	2.19	1.02	1	4	.98	.99	.99
16	… giving up the attempt to cope.	1.11	.34	1	4	1.13	0.42	1	4	1.00	1.00	1.00
17	… looking for something good in what is happening.	2.29	.99	1	4	2.57	1.00	1	4	.99	1.00	1.00
18	… making jokes about it.	2.08	.97	1	4	2.15	1.01	1	4	1.00	1.00	1.00
19	… doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping.	1.85	.84	1	4	2.54	0.96	1	4	.97	.98	.99
20	… accepting the reality of the fact that it has happened.	2.16	1.01	1	4	2.24	1.01	1	4	.68	.72	.95
21	… expressing my negative feelings.	1.33	.58	1	4	1.67	0.84	1	4	.52	.62	.84
22	… trying to find comfort in my religion or spiritual beliefs.	1.37	.75	1	4	1.51	0.85	1	4	.84	.86	.98
23	… trying to get advice or help from other people about what to do.	2.06	.83	1	4	2.52	0.92	1	4	.54	.62	.87
24	… learning to live with it.	2.37	.97	1	4	2.46	0.97	1	4	.90	.91	.99
25	… thinking hard about what steps to take.	2.41	.94	1	4	2.67	0.95	1	4	.03	.03	.97
26	… blaming myself for things that happened.	1.89	.90	1	4	2.03	0.96	1	4	.50	.57	.87
27	… praying or meditating.	1.17	.53	1	4	1.34	0.71	1	4	.03	.12	.22
28	… making fun of the situation.	2.36	.96	1	4	2.45	0.99	1	4	.09	.18	.49

Note. ϱ_c = concordance correlation coefficient (comprising the measures of precision ϱ and accuracy C_b); ϱ = precision of concordance (Pearson correlation coefficient measuring how far each observation deviates from the line of best fit); C_b = accuracy of concordance (bias correction factor measuring how far the line of best fit deviates from the line through the origin).

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Most of the mean item values were below the midpoint of the scale (2.50). Only item 12 ("during lessons" context) and items 5, 7, 12, 14, 17, 19, 23 and 25 ("outside of lessons" context) were above the midpoint. The lowest mean item values were $M = 1.02$ ($SD = 0.14$) for item 4 and $M = 1.02$ ($SD = 0.22$) for item 11 in the "during lessons" context, and $M = 1.13$ ($SD = 0.40$) for item 11 and $M = 1.13$ ($SD = 0.42$) for item 16 in the "outside of lessons" context. In this case, the items (particularly for the context "during lessons") were not sufficiently dispersed around the midpoint of the scale according to DeVellis.[98] The highest mean item values were $M = 2.57$ ($SD = 0.89$) for item 12 in the "during lessons" context and $M = 2.90$ ($SD = 0.90$) for item 14 in the "outside of lessons" context.

III.2.1.2. Item multicollinearity

Results for multicollinearity analyses are displayed in Table 3 (bivariate correlations) and Table 4 (tolerance scores). Bivariate correlations were clearly below $r = .90$ which is a first indicator of the absence of multicollinearity (cf. the guidelines by Tabachnick and Fidell[99]). At the same time, results revealed a substantial number of correlations higher than $r = .30$, indicating that factor analysis was appropriate.[100] Subsequently, tolerance scores for every item were calculated, taking into account all the other items of the highest-order factor the respective item was allocated to. This was only done for model 2 and 3, because model 1 only consisted of one level of factors with only two items per factor (in cases of only two items per factor, the tolerance score is based on simple R^2 which is derivable from simple bivariate correlation; see Table 2). For example, for item 2, the tolerance scores for model 2 for both contexts were based on item 7, 10, 14, 23 and 25 because these items make up the highest-order factor "problem-focused coping" of model 2 (cf. Fig. 2). All tolerance scores were clearly above the critical cut-off value of .10, finally indicating an absence of multicollinearity (cf. the guidelines by Hair et al.[101]).

III.2.1.3. Item difficulty and item discrimination

Psychometric item properties are displayed in Table 2 and Table 5. As indicated by the aforementioned mean values, item difficulties are low to

[98] Robert F. DeVellis and Carolyn T. Thorpe. *Scale Development: Theory and Applications*. Sage, 2021, 102–17.

[99] Tabachnick and Fidell, *Using Multivariate Statistics*, 93–152.

[100] Joseph F. Hair et al., *Multivariate Data Analysis*, 196–97.

[101] Joseph F. Hair et al., *Multivariate Data Analysis*, 196–97.

Table 3

Intercorrelations between items

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
(1)		.17**	.23**	.05	-.05	.26**	-.08	.10*	.01	.01	-.02	-.03	.14**	.00	-.06	.08	-.07	.18**	.25**	-.16**	.04	-.08	-.02	-.05	-.06	-.02	-.03	.10*
(2)	.17**		.19**	.09*	.09	.00	.30**	.19**	.10*	.09*	-.06	.09*	.21**	.32**	.19**	.05	.14**	.10*	.15**	.07	.12*	.05	.16**	.09*	.22**	.13**	.08	-.03
(3)	.22**	.11*		.11*	.05	.14**	-.01	.29**	.03	.02	-.01	-.01	.14**	.04	.11*	.22**	-.03	.10*	.15**	.02	.10*	.05	.00	.02	.15**	.09*	.02	-.05
(4)	.12**	.06	.13**		-.05	.04	-.08	.08	.00	.00	.08	-.07	.02	-.03	-.03	.09	-.09*	-.03	.02	-.08	.07	.08	-.03	-.02	.00	-.02	.08	.01
(5)	.12**	.18**	.05	.07		-.01	.24**	.08	.19**	.35**	.09*	.17**	.08	.22**	.43**	.03	.19**	.15**	.19**	.12*	.20**	.08	.42**	.18**	.18**	.06	.16**	.10*
(6)	.08	.01	.16**	.20**	-.05		-.09	.10*	.04	.05	.01	-.07	.05	-.04	.07	.16**	-.10*	.10*	.08	.06	.02	-.08	.03	-.01	-.08	-.01	-.01	.02
(7)	-.06	.35**	-.06	-.06	.29**	-.13**		.06	.14**	.32**	-.06	.36**	.10*	.42**	.29**	-.07	.27**	.16**	.18**	.18**	.13**	.09*	.32**	.26**	.25**	.18**	.06	.10*
(8)	.15**	.15**	.34**	.13**	.08	.15**	.09*		.11*	.12**	.10*	.04	.26**	.05	.21**	.18**	.02	.11*	.14**	.04	.16**	.16**	.10*	.00	.15**	.22**	.101	-.08
(9)	.02	.10*	.09	.04	.26**	-.05	.16**	.17**		.20**	-.01	.14**	.04	.12**	.18**	.05	.15**	.11*	.25**	.13**	.26**	.07	.14**	.13**	.14**	.07	.09*	.17**
(10)	.09*	.19**	.01	.04	.36**	-.02	.34**	.19**	.31**		-.05	.24**	.12**	.25**	.36**	.01	.15**	.21**	.24**	.12**	.20**	.10*	.55**	.19**	.17**	.09	.12**	.13**
(11)	.02	.05	.08	.63**	.08	.12**	.01	.14**	.07	.04		-.13**	.08	-.03	.11*	.17**	-.06	.03	.05	.06	.13**	.15**	.11*	.03	-.02	.04	.17**	.01
(12)	.12*	.17**	-.02	.00	.34**	.01	.38**	.06	.18**	.34**	.02		.12**	.34**	.22**	-.08	.43**	.25**	.19**	.23**	.09	.19**	.26**	.31**	.28**	.12**	.14**	.23**
(13)	.19**	.20**	.25**	.12**	.15**	.14**	.04	.23**	.14**	.14**	.12*	.14**		.23**	.23**	.14**	.13**	.15**	.11*	.03	.19**	.097*	.17**	.10*	.21**	.39**	.11*	-.03
(14)	.06	.32**	.08	.01	.23**	-.09*	.49**	.10*	.19**	.31**	.11*	.44**	.27**		.28**	-.07	.33**	.21**	.30**	.20**	.05	.11*	.31**	.26**	.42**	.12**	.11*	.16**
(15)	.15**	.17**	.10*	-.01	.46**	.00	.30**	.25**	.25**	.48**	.07	.30**	.25**	.36**		.06	.23**	.24**	.21**	.18**	.26**	.13**	.43**	.17**	.24**	.11*	.14**	.01
(16)	.07	.02	.29**	.12**	.02	.18**	-.06	.21**	.11*	.09*	.08	-.03	.18**	-.01	.03		-.08	.09	.06	.06	.14**	.05	.06	.02	.03	.07	.03	-.04
(17)	.10*	.20**	.02	.03	.30**	-.03	.31**	.05	.19**	.26**	.01	.48**	.18**	.36**	.31**	-.02		.34**	.27**	.22**	.06	.20**	.27**	.34**	.34**	.10*	.19**	.20**
(18)	.12**	.10*	.08	.11*	.08	.06	.14**	.07	.09*	.20**	.11*	.23**	.12*	.20**	.16**	.05	.36**		.31**	.13**	.17**	-.02	.24**	.19**	.23**	.12**	.03	.50**
(19)	.31**	.21**	.15**	.13**	.20**	.02	.24**	.17**	.18**	.32**	.10*	.27**	.22**	.27**	.22**	.05	.34**	.32**		.09	.12*	.08	.24**	.08	.18**	.04	.13**	.17**
(20)	.04	.08	.05	-.01	.15**	.06	.20**	.15**	.16**	.17**	.00	.21**	.13**	.22**	.25**	.08	.24**	.10*	.20**		.17**	.09	.26**	.49**	.22**	.20**	-.03	.12*
(21)	.11*	.17**	.12*	.13**	.25**	.03	.11*	.21**	.32**	.27**	.15**	.16**	.25**	.12**	.39**	.14**	.16**	.12*	.19**	.22**		.18**	.34**	.14**	.16**	.17**	.19**	.01
(22)	.11*	.06	.08	.00	.10*	-.03	.12*	.09	.01	.04	-.02	.18**	.09	.15**	.16**	.01	.20**	-.01	.06	.12*	.08		.18**	.11*	.17**	.10*	.54**	-.02
(23)	.08	.19**	.03	.03	.41**	-.06	.34**	.15**	.24**	.64**	.04	.34**	.16**	.36**	.52**	.00	.34**	.18**	.35**	.29**	.40**	.16**		.27**	.35**	.15**	.16**	.09*
(24)	.03	.10*	.00	.05	.20**	.02	.21**	.08	.19**	.19**	.08	.31**	.12**	.26**	.21**	.06	.38**	.19**	.20**	.54**	.18**	.15**	.25**		.28**	.15**	.13**	.19**
(25)	.12*	.21**	.08	.03	.30**	-.05	.31**	.22**	.23**	.30**	.07	.34**	.25**	.43**	.36**	.02	.33**	.29**	.27**	.28**	.25**	.15**	.38**	.29**		.22**	.14**	.12*
(26)	.09	.10*	.12**	.09*	.06	.07	.06	.20**	.08	.08	.10*	.07	.43**	.19**	.12**	.10*	.13**	.10*	.12**	.21**	.21**	.04	.13**	.16**	.26**		.04	.08
(27)	.07	.08	.07	.00	.09	-.01	.07	.05	.03	.05	.00	.14**	.07	.10*	.11*	.03	.16**	.06	.04	.06	.10*	.63**	.12**	.16**	.15**	.04		.08
(28)	.04	.02	-.06	.07	.04	.00	.15**	-.09	.11*	.07	.06	.17**	-.08	.13**	-.01	-.10*	.22**	.50**	.19**	.13**	-.02	-.03	.05	.17**	.11*	.05	.04	

Note. Values above the diagonal display correlations for the context "during lessons", values below the diagonal display correlations for the context "outside of lessons".

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

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Table 4

Tolerance scores of items for analysis of multicollinearity

Item	„During lessons"		„Outside of lessons"	
	Model 2	Model 3[a]	Model 2	Model 3[a]
1	.81		.85	
2	.85	.86	.84	.85
3	.84	.90	.83	.85
4	.87		.53	
5	.79	.73	.71	.74
6	.97		.93	
7	.75	.79	.68	.71
8	.85	.83	.81	.82
9	.92	.93	.87	.88
10	.65	.65	.56	.56
11	.84		.54	
12	.75	.78	.66	.73
13	.82	.80	.76	.75
14	.68	.70	.65	.66
15	.71	.74	.68	.63
16	.93		.93	
17	.67	.73	.60	.65
18	.58	.69	.62	.68
19	.77		.70	
20	.70	.75	.65	.71
21	.87	.89	.82	.82
22	.67	.71	.58	.59
23	.61	.60	.54	.52
24	.66	.68	.61	.63

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Item	„During lessons"		„Outside of lessons"	
	Model 2	Model 3[a]	Model 2	Model 3[a]
25	.76	.81	.75	.80
26	.84	.82	.80	.79
27	.68	.70	.60	.60
28	.67	.74	.68	.74

Note. Tolerance scores for every item were calculated taking into account all the other items of the highest-order factor the respective item was allocated to. This was only done for model 2 and 3, because model 1 only comprised one level of factors with only two items per factor (in cases of only two items per factor, the tolerance score is based on simple R^2 which is derivable from simple bivariate correlation; see Table 2).

[a] Missing tolerance scores occur because some items were omitted from model 3 according to the a priori conceptualization of the factor structure.

Table 5

Psychometric item properties for second-level factors of model 3

Factor	Item	Context "During lessons"			Context "Outside of lessons"			Concordance		
		r_{id}	*H* (SD)	α	r_{id}	*H* (SD)	α	ϱ_c	ϱ	C_b
Focus on positive	20	.36	.28 (0.12)	.70	.37	.29 (0.14)	.71	.85	.87	.97
	24	.49			.51					
	12	.44			.44					
	17	.47			.52					
	18	.44			.43					
	28	.38			.60					
Support	10	.50	.27 (0.17)	.70	.52	.29 (0.21)	.72	.55	.70	.79
	23	.57			.60					
	5	.46			.45					
	15	.48			.55					
	22	.25			.29					
	27	.32			.27					

Factor	Item	Context "During lessons"			Context "Outside of lessons"			Concordance		
		r_{id}	*H* (SD)	α	r_{id}	*H* (SD)	α	ϱ_c	ϱ	C_b
Active Coping	2	.37			.38					
	7	.43	.32 (0.08)	.66	.52	.35 (0.09)	.68	.64	.73	.88
	14	.54			.57					
	15	.25			.42					
Evasive Coping	13	.38			.44					
	26	.35			.36					
	3	.22	.17 (0.10)	.55	.27	.21 (0.10)	.61	.65	.75	.87
	8	.37			.36					
	9	.17			.27					
	21	.31			.39					

Note. r_{id} = item discrimination; *H* = item homogeneity; α = internal consistency; ϱ_c = concordance correlation coefficient (comprising the measures of precision ϱ and accuracy C_b); ϱ = precision of concordance (Pearson correlation coefficient measuring how far each observation deviates from the line of best fit); C_b = accuracy of concordance (bias correction factor measuring how far the line of best fit deviates from the line through the origin).

medium. The item discrimination (as indicated by mean inter-item correlation[102]) varied between r_{id} = .17 and r_{id} = .60 for the best fitting factor structure (i.e., model 3). Three items were below the recommended discrimination minimum of r_{id} = .30[103] in both contexts (item 3, item 9, item 22), with item 3 and item 9 stemming from the factor "evasive coping" and item 22 stemming from the factor "support". Also, discrimination was low for item 15 (context "during lessons") and item 22 (context "outside of lessons").

III.2.1.4. Concordance

Concordance coefficients of the items are displayed in Table 2. Concordance between the two contexts varied between low (ϱ_c = .02) and

[102] Markus Bühner. *Einführung in die Test- Und Fragebogenkonstruktion*. (Introduction to test and questionnaire construction). München: Pearson Studium, 2011, 171–79.

[103] Bühner, *Einführung*, 171–79.

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perfect concordance ($\varrho_c = 1.00$).[104] Almost half of the items showed high to perfect concordance.

III.2.2. Psychometric analyses of factors

III.2.2.1. Homogeneity and internal consistency

Psychometric factor properties are displayed in Table 5. The homogeneity was between $H = .17$ ($SD = 0.10$) and $H = .35$ ($SD = 0.09$), which corresponds to relatively homogeneous factors even when taking into account the standard deviations.[105] The internal consistency was low (i.e., unacceptable) to acceptable with Cronbach's Alpha values ranging from $\alpha = .55$ (factor "evasive coping") and $\alpha = .72$ (factor "support").

III.2.2.2. Concordance

Concordance coefficients of the factors are displayed in Table 5. Concordance between the two contexts was high.

IV. Discussion

The high prevalence of stress and the negative consequences of stress among university students raises the need for effective coping strategies in this population. Thus, appropriate instruments to measure coping are required in order to understand how university students can be supported. Recent studies on coping instruments in general[106,107,108] and the Brief COPE in particular[109,110,111] report inconsistencies in coping dimensions. Therefore, the aim of the present study was to analyze three different factor structures of the situational version of the Brief COPE in two contexts of university education (i.e., during lessons and outside of lessons) by using an appropriate methodological procedure. Results show that a two-level factor structure fits

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[104] McBride, G. B. "A Proposal for Strength-of-Agreement Criteria for Lin's Concordance Correlation Coefficient." National Institute of Water & Atmospheric Research Ltd, Hamilton, New Zealand, 2005, 6.

[105] Bühner, *Einführung*, 178–81.

[106] Cook and Heppner, „A Psychometric Study," 906–23.

[107] De Ridder, "What Is Wrong," 417–31.

[108] Katharine H. Greenaway, Winnifred R. Louis, Stacey L. Parker, Elise K. Kalokerinos, Joanne R. Smith, and Deborah J. Terry (2015), 322–51.

[109] Brasileiro et al., "Controversies," 1–14.

[110] Krägeloh, "A Systematic Review," 216–46.

[111] Monzani et al., „The Situational Version," 295–310.

the data best for both contexts, but that an individual's coping strategies may differ between contexts. Although, from a strictly psychometric point of view, some items of the Brief COPE have limitations with respect to their applicability in the university context, the overall findings support the applicability of the situational version of the Brief COPE in research and practice.

Regarding the factor structure of the Brief COPE, the results lend support to the two-level factor structure that was identified by Knoll et al.[112] This structure organizes specific coping strategies (first-level factors) around a set of four superordinate factors (second-level factors). The superordinate factors describe different coping purposes (focus on positive, support, active coping, evasive coping) that, in sum, comprise eleven (acceptance, positive reframing, humor, use of instrumental support, use of emotional support, religion, active coping, planning, self-blame, denial and venting) of the 14 original first-level factors (behavioral disengagement, self-distraction and substance use were omitted).

This two-level conceptualization is in line with Schwarzer and Schwarzer's[113] general suggestion to use multi-level conceptualizations of coping strategies. Multi-level conceptualizations comprise relatively stable (i.e., stable over context and time) coping dimensions at superordinate levels and a variety of specific strategies and acts at subordinate levels. Such a conceptualization takes into account that an individual may have general coping tendencies (superordinate) that may be stable, but that specific strategies and acts which are subordinate to a general coping tendency may only work in one specific context or situation. This is particularly true for university students as it has been shown that stress is more prevalent at different times during a university semester.[114]

The adequacy of this multi-level conceptualization is also reflected in the context comparisons of the Brief COPE. While the multi-level conceptualization is stable across both contexts, the individual use of a specific coping strategy differs between contexts. Some strategies are used by individuals in one context but not in the other. For example, a university student who prefers active coping (superordinate level) may use the strategy to think thoroughly about what steps to take (subordinate level) during a stressful university lesson but will not take any action to try to improve the

[112] Knoll, Rieckmann, and Schwarzer, „Coping As A Mediator," 233–34.

[113] Schwarzer and Schwarzer, „A Critical Survey," 109.

[114] Adele Pitt et al., "An Exploratory Study of Students' Weekly Stress Levels and Sources of Stress During the Semester," *Active Learning in Higher Education* 19, no. 1 (2017): 61, https://doi.org/10.1177/1469787417731194.

situation (subordinate level) because he does not want to disturb the lesson (e.g., by leaving the lesson). On the contrary, he may take action to try to improve the situation outside of class.

The differences in the individual use of certain coping strategies between contexts have additional implications for the psychometric item properties of the Brief COPE. In comparison to common evaluation standards[115], some partial limitations were found regarding the psychometric item characteristics of the Brief COPE. These limitations relate to item discrimination, internal consistency and factor loadings. In particular, these parameters were low for items asking for evasive coping and for support coping. These limitations can be explained from a content-related and a methodological perspective. In terms of content-related explanations, the aforementioned instability of certain coping strategies and acts across contexts and over time needs to be considered. For example, it is difficult to say things during lessons in order to let unpleasant feelings escape (item 9; evasive coping), whereas it is less difficult outside of lessons. Furthermore, the width of factors must be taken into account. Specifically, support coping is a broad factor as it comprises instrumental support, emotional support and religion. Religion and faith might be important only for certain groups of people,[116] whereas instrumental and emotional support seem to be important for everyone given the human need for relatedness.[117] With regard to methodological explanations, aspects relating to statistics and operationalization need to be considered. In terms of statistics, internal consistency can be underestimated when there is a low number of items.[118] Moreover, a low number of items can have an impact on factor loadings. It is more likely that low factor loadings occur when there are only two items per (first-level) factor. In the present study, however, a restriction to two items per factor was necessary because a short version of a questionnaire was evaluated. Regarding operationalization, one should mention that the operationalization of instrumental and emotional support coping differs from the operationalization of religion. While the items for instrumental and emotional support ask for "getting" support, the items for religion ask for active support acts ("praying", "meditating"). Such

[115] Bühner, *Einführung*, 141–478.

[116] Cook and Heppner, „A Psychometric Study," 920.

[117] Roy F. Baumeister and M. R. Leary, "The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation," *Psychological Bulletin* 117, no. 3 (1995): 497–529, https://doi.org/10.1037/0033-2909.117.3.497.

[118] J. M. Cortina, "What Is Coefficient Alpha? An Examination of Theory and Applications," *Journal of Applied Psychology* 78, no. 1 (1993): 101–02, https://doi.org/10.1037/0021-9010.78.1.98, 10.1037/0021-9010.78.1.98.

differences in item wording can account for limitations in psychometric item properties.

Despite the limitations that arise when scrutinizing the psychometric properties, the findings of this study support the applicability of the situational version of the Brief COPE in research and practice from a content-related point of view. Firstly, the support of application is endorsed by the cross-context stability of the best fitting Brief COPE factor structure. Secondly, since coping strategies are interdependent and flexible[119], an elimination of items that do not perfectly fit psychometric criteria (e.g., religion items) would decrease the face validity of a coping questionnaire. Thirdly, having more general coping dimensions at superordinate levels (e.g., for research) and a variety of specific strategies and acts at subordinate levels (e.g., for practice), complies with previous recommendations.[120] Thus, for content validity in general and face validity in particular, as well as for the usefulness of the questionnaire, it is reasonable to maintain the identified factor structure for assessing situational coping.

Despite these benefits found in terms of the factor structure of the situational version of the Brief COPE, it remains open whether this factor structure could also be appropriate for the dispositional version of the Brief COPE. Situational coping can be defined as concrete coping in a specific situation, whereas dispositional coping can be defined as the general habitual coping tendency of an individual.[121] Previous studies have conceptualized and measured situational and dispositional coping in different ways. Some of them have conceptualized and measured them in a symmetric manner. This means that they assumed the same dimensions in both situational and dispositional coping, and used the same questionnaire but with different instructions.[122,123] Others have conceptualized and measured them in an asymmetric manner. They assumed different dimensions and used different questionnaires for situational and dispositional coping (for an example, see

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[119] Cook and Heppner, "A Psychometric Study," 919.

[120] Schwarzer and Schwarzer, "A Critical Survey," 109.

[121] Geneviève Bouchard, Annie Guillemette, and Nicole Landry-Léger, "Situational and Dispositional Coping: An Examination of Their Relation to Personality, Cognitive Appraisals, and Psychological Distress," *European Journal of Personality* 18, no. 3 (2004): 222, https://doi.org/10.1002/per.512.

[122] Bouchard, Guillemette, and Landry-Léger, "Situational and Dispositional Coping": 223.

[123] Jasna Hudek-Knežević and Igor Kardum, "The Effects of Dispositional and Situational Coping, Perceived Social Support, and Cognitive Appraisal on Immediate Outcome," *European Journal of Psychological Assessment* 16, no. 3 (2000): 193–94, https://doi.org/10.1027//1015-5759.16.3.190.

[124]). Therefore, future studies should investigate the most appropriate factor structure of the dispositional version of the Brief COPE and compare this to the situational version. The identification of the factor structures of the situational version and the dispositional version could be fruitful for further research on coping in students. Studies should further investigate the impact of dispositionally preferred coping strategies and their interaction with appraisal on situational coping.[125,126]

IV.1. Study strengths, limitations and future research

In accordance with the study aim, the strengths of the present study lie in the comparison of different contexts and in the application of appropriate statistical procedures to identify the most appropriate factor structure of the Brief COPE. Despite these strengths, there are some limitations to the generalizability of the present study and to the validity of the identified factor structure of the Brief COPE that need to be addressed in future studies. First, future studies should examine the temporal stability of coping as assessed by the Brief COPE by applying a longitudinal design. Second, although the two-level structure identified by Knoll et al.[127] was found to be best in our study and stable for the chosen contexts, future studies should extend its context generalizability in order to check the robustness of the underlying factor structure. This could be done by examining contexts that are more disparate from each other (e.g., the university education context and leisure time context). In this regard, future studies should also check whether there are order effects when asking the participants to indicate their coping in different contexts. In the present study, participants were first asked to indicate their coping during lessons and then their study-related coping outside of lessons. This could have led to uncontrolled priming effects from the first context (coping during lessons), although we do not think that such a priming effect occurred given the different measures of concordance we have found. Third,

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[124] Margaret R. Bauer et al., "Dispositional and Situational Avoidance and Approach as Predictors of Physical Symptom Bother Following Breast Cancer Diagnosis," *Annals of Behavioral Medicine A Publication of the Society of Behavioral Medicine* 50, no. 3 (2016): 375-76, https://doi.org/10.1007/s12160-015-9763-7.

[125] Hudek-Knežević and Kardum, "The Effects Of," 198–200.

[126] Saija Mauno and Marika Rantanen, "Contextual and Dispositional Coping Resources as Predictors of Work–family Conflict and Enrichment: Which of These Resources or Their Combinations Are the Most Beneficial?," *Journal of Family and Economic Issues* 34, no. 1 (2013): 101–02, https://doi.org/10.1007/s10834-012-9306-3.

[127] Knoll, Rieckmann, and Schwarzer, "Coping As A Mediator," 233–34.

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studies should investigate the factor structure of the dispositional version of the Brief COPE. Fourth, future studies should test the criterion validity of the identified factor structure of the Brief COPE. For instance, it could be correlated with subjective and objective parameters of stress and well-being. Fifth, future studies should test the Brief COPE criterion validity by cross-correlating it with an observer coping inventory.[128] Sixth, studies should widen the cultural validity, taking into account that the Brief COPE has in general been translated into several languages in previous studies and that we have specifically used an existing German language translation which might have changed item meanings. Brasileiro and colleagues[129] summarize that cultural and socioeconomic factors have an influence on coping. Moreover, previous studies have found that deriving benefits from successfully coping with stress is perceived differently between ethnic groups.[130] Consequently, the factor structure of the Brief COPE could be suitable only for Western culture, yielding inconsistent dimensionality when used across cultures. The problem could be solved by finding consensus among researchers (e.g., with the use of expert conferences) about how coping strategies should conceptualized across cultures, or by identifying explicit differences between cultures in terms of coping.

V. Conclusions

In the present study, the factor structure of the Brief COPE was tested as an instrument to measure coping for both practical application and research. With regard to practical application, the first level of the multi-level conceptualization of the coping dimensions in the Brief COPE can be particularly helpful for practitioners that want to analyze coping in students in order to develop non-clinical stress management interventions (for overviews of stress reduction interventions in students[131,132]). Helpful for

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[128] Kyunghee Han et al., "Evaluation of an Observer Form of the Coping Inventory for Stressful Situations," *Educational and Psychological Measurement* 69, no. 4 (2009): 675–95, https://doi.org/10.1177/0013164409332220.

[129] Brasileiro et al., "Controversies," 10.

[130] Vaughn, Roesch, and Aldridge, "Stress-Related Growth," 136–39.

[131] Cheryl Regehr, Dylan Glancy, and Annabel Pitts, "Interventions to Reduce Stress in University Students // Interventions to Reduce Stress in University Students: A Review and Meta-Analysis: A Review and Meta-Analysis," *Journal of Affective Disorders* 148, no. 1 (2013): 1–11, https://doi.org/10.1016/j.jad.2012.11.026.

[132] Miryam Yusufov et al., "Meta-Analytic Evaluation of Stress Reduction Interventions for Undergraduate and Graduate Students," *International Journal of Stress Management* 26, no. 2 (2019): 132–45, https://doi.org/10.1037/str0000099.

interventions is also that we were able to show that the Brief COPE can be applied in different contexts of university education (i.e., during lessons, outside of lessons). This fact will enable practitioners to provide students with study-related coping strategies to use outside of university lessons (e.g., to deal with their workload) and during university lessons (e.g., to deal with exam anxiety or public speaking). Thus, the Brief COPE could be used as part of an additional assessment which could also include measures of stress and stress-related constructs (e.g., resilience[133]).

In terms of research, the Brief COPE can be used, for instance, to examine the impact of different coping dimensions on perceived stress. Additionally, it can be used in order to investigate further moderators of the relationship between coping and stress reaction.[134] For research purposes, we recommended analyzing data only on the second factor level, since factors on the first level have a low reliability and insufficient factor loadings.

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[133] Ethel Chung, Deborah Turnbull, and Anna Chur-Hansen, "Differences in Resilience Between 'Traditional' and 'Non-Traditional' University Students," *Active Learning in Higher Education* 18, no. 1 (2017): 80, https://doi.org/10.1177/1469787417693493.

[134] Julia Lawrence, Kelly Ashford, and Paul Dent, "Gender Differences in Coping Strategies of Undergraduate Students and Their Impact on Self-Esteem and Attainment," *Active Learning in Higher Education* 7, no. 3 (2016): 277–80, https://doi.org/10.1177/1469787406069058.

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