

Research Article

Comparison of self-determination theory components in a face-to-face physical activity promotion college course

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Physical activity courses utilizing Self-Determination Theory have been shown to improve physical activity levels, fulfill the needs of Self-Determination Theory, and increase autonomous motivation for regular physical activity in different student populations. This study examined the implementation and effectiveness of Self-Determination Theory-based strategies within an undergraduate Physical Activity course at a Southeastern United States regional state university. Undergraduate participants were enrolled in an introductory, undergraduate Physical Activity course that discussed physical fitness, chronic diseases, impacts of physical activity and most importantly the role that physical activity should play in a healthy lifestyle. Physical Activity levels, needs support, satisfaction, and autonomous motivation for physical activity were examined via questionnaires at three-time points: at the start of the semester, mid semester, and at the end of the semester. Students' physical activity levels significantly increased from baseline to endpoint. A significant decrease in competency support was observed. Autonomy satisfaction increased significantly, while relatedness satisfaction decreased. Autonomous motivation remained constant. The course was effective in increasing the physical activity levels of students. Results suggest that the course did not facilitate an encompassing needs supportive environment, nor was it able to satisfy all three needs of Self-Determination Theory, despite improving autonomy satisfaction and physical activity. This study highlights the need to implement effective needs-supporting strategies for greater improvements in physical activity.

Keywords: Physical activity; Self-determination theory; Undergraduate students

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1. Introduction

Regular physical activity is associated with positive health outcomes and a reduced risk of all causes of mortality, yet a third of undergraduates fail to meet physical activity and public health recommendations of 150 minutes of moderate or 75 minutes of vigorous physical activity each week (U.S Department of Health and Human Services, 2018). Alongside the well-established benefits of meeting physical activity recommendations, meeting physical activity recommendations has also been shown to positively impact undergraduates' mental well-being (Ning, 2020), which is critical as mental health concerns rise in college populations (Flannery, 2023). Thus, physical activity may be a promising non-pharmaceutical strategy to improve mental well-being in college students during a pivotal time in their lives.

With a third of the undergraduate population failing to experience the positive health outcomes associated with regular physical activity, strategies promoting regular participation in physical activity to undergraduate students is warranted (Vaughn et al., 2019). One potential strategy to promote lifelong,

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regular physical activity among undergraduates is the implementation of physical activity courses as part of the undergraduate curriculum. These courses aim to disseminate educational material and equip undergraduate students with skills to live an active lifestyle for optimal holistic health (Maselli et al., 2018). The implementation of theory-based practices within these courses has been a common and successful strategy (Juwono & Szabo, 2020;).

1.1. Self-Determination Theory

The Self-Determination Theory [SDT] suggests that fulfilling the basic needs of competency, autonomy, and relatedness will facilitate individuals in becoming autonomously motivated to engage in an activity (Deci & Ryan, 2000, 2008). In other words, individuals are autonomously motivated to engage in an activity simply because they enjoy it. SDT proposes that the quality of one's motivation, especially the extent to which it is autonomous rather than controlled, plays a main role in determining long-term behavioral adherence. Within SDT, the fulfillment of three basic psychological needs is considered essential for the development and maintenance of autonomous motivation: autonomy, competence, and relatedness. Autonomy refers to the ability to self-organize an activity, competence refers to one's level of confidence or ability to engage in an activity, and relatedness refers to one's connection with the activity or others (Deci & Ryan, 2000, 2008).

When educational environments support these needs, individuals are more likely to internalize the value of physical activity and engage in it for personally meaningful reasons, rather than external pressures. In contrast, when the environment undermines these needs, motivation tends to remain externally regulated, leading weaker behavioral persistence and lower psychological well-being (Ryan & Deci, 2000). SDT provides a theoretically grounded framework for designing instructional strategies that not only increase physical activity participation in the short term, but also strengthens long-term adherence (Teixeira et al., 2012). The use of Self-Determination Theory strategies within physical activity courses is a promising strategy for the promotion of regular physical activity for undergraduate students.

1.2. Literature Review

A growing amount of research has applied SDT principles to physical activity interventions within university contexts. Studies have demonstrated that instructional environments emphasizing personal choice, meaningful rationales for activities, acknowledgment of students' perspectives, and collaborative peer interactions can enhance autonomy support, strengthen perceived competence, and foster social connectedness (Corella et al., 2019; Gonzalez-Cutre et al., 2018; Ha et al., 2020). Such environments have been associated with improvements in physical activity behavior, psychological need satisfaction, and intrinsic or autonomous motivation among undergraduates (Chatzisarantis & Hagger, 2009; Pauline, 2013; Quartiroli & Maeda, 2014).

Despite these positive findings, existing research also highlights several limitations and gaps. First, interventions often emphasize educational or informational strategies related to exercise knowledge and health outcomes, while providing comparatively fewer structured opportunities to build a sustained sense of competence or belonging (Das & Evans, 2014; Maselli et al., 2018). Second, although many interventions successfully increase short-term physical activity levels, fewer demonstrate clear improvements in autonomous motivation, suggesting that one or more psychological needs may not be adequately supported within these instructional contexts (Friederichs et al., 2015; Juwono & Szabo, 2020). Third the degree to which instructors are trained and supported in delivering SDT-informed strategies appears to be an important determinant of intervention effectiveness, yet many studies provide limited documentation of instructional fidelity or pedagogical support (Corella et al., 2019; Gonzalez-Cutre et al., 2018).

Taken together, these gaps underscore the importance of examining not only the behavioral outcomes of physical activity courses, but also the underlying motivational mechanisms that contribute to long-term engagement. The present study seeks to address these gaps by evaluating the effectiveness of SDT-based strategies implemented within an undergraduate physical activity course, with a focus on physical activity behavior, need support, need satisfaction, and autonomous motivation over the course of a semester.

The education and promotion of physical activity during the formative years of college are important as behaviors can translate across one's lifespan (Das & Evans, 2014; Vainshelboim et al., 2019). However, the use of education alone is ineffective (Dishman & Buckworth, 1996; Juwono & Szabo, 2020). As a result, physical activity courses should use education alongside theory-based behavioral modification strategies (Ryan, 2021). The purpose of this study was to evaluate the effectiveness of SDT-based instructional strategies within an undergraduate physical activity course in promoting physical activity behavior, need support, need satisfaction, and autonomous motivation across a 16-week semester. Understanding how SDT strategies operate in real-world educational course settings can inform course design to improve student

well-being and promote lifelong physical activity habit formation. This study addresses identified gaps by examining not only physical activity outcomes, but the satisfaction of autonomy, competence, and relatedness within a natural university course structure.

2. Methods

2.1 Research Design

A quasi-experimental pretest-posttest design was used to evaluate the effectiveness of SDT-based instructional strategies implemented in an undergraduate physical activity course over a 16-week semester. Data were collected at the beginning (pretest) and end (posttest) of the semester to assess changes in the study variables.

2.2. Participants

Undergraduate students enrolled in a required introductory Physical Activity course at a large public, regional university in the southeastern United States were recruited for this study. Students enrolled in the course were contacted via in-person during class time and online messages for the online course during the first three weeks of the semester. To encourage participation, volunteers were provided with extra credit in the course for completing the administered surveys. To avoid coercion, several alternative extra credit opportunities were offered throughout the course. Participants were required to be at least 18 years of age and an undergraduate student enrolled in the course. Exclusions occurred if any contraindications to the course were noted. The minimal inclusion and exclusion criteria were to encourage participation from all students enrolled in the course. A total of 117 students completed at least two of the three questionnaires administered. The average age of students ($N = 117$) was 19.8 ± 1.93 years and ranged between 19 and 27 years. The majority of students who completed the questionnaires were full-time students (99.1%), Female (68.2%) and White (76.4%). The majority of students were classified as Sophomores (46.8%). Details are provided in Table 1.

Table 1
Participant Demographics

<i>Characteristic</i>	<i>Mean (SD) or n (%)</i>
Sex	
Male	34 (31.8%)
Female	73 (68.2%)
Body Mass Index	25.4 (6.6)
Race	
Asian	3 (2.7%)
Black	12 (10.9%)
White	84 (76.4%)
Other	11 (10.0%)
Year in School	
First Year	4 (3.7%)
Sophomore	51 (46.8%)
Junior	35 (32.1%)
Senior	17 (15.6%)
5th Year	2 (1.8%)
GPA	
2.00-2.49	1 (0.9%)
2.50-2.99	12 (11.1%)
3.00-3.49	37 (34.3%)
3.50-3.99	48 (44.4%)
4.0	10 (9.3%)
Employment Status	
Full-Time	5 (4.5%)
Part-Time	37 (33.6%)
Full-Time Student	68 (61.8%)

2.3. Data Collection

Questionnaires were available at the beginning, midpoint, and endpoint of the 16-week course. Baseline questionnaires were available during the first three weeks and after informed consent was obtained from participants. Participants that completed the baseline questionnaire were sent follow-up questionnaires at midpoint and endpoint; both questionnaires were available over two weeks. Inclusion in data analysis required the completion of two of the three questionnaires, with at least one being at baseline.

The short form International Physical Activity Questionnaire [IPAQ] 7-day recall was used to assess total physical activity engaged in over 7 days (Craig et al., 2003). Following the IPAQ data processing protocols, results were truncated if activity bouts greater than 3 hours were reported, and if more than 16 hours of total activity were reported results were excluded (Craig et al., 2003). Responses were analyzed as total MET minutes of physical activity per week.

A 24-item questionnaire on a 7-point Likert scale based on the work of Standage et. al. (2005) and Williams and Deci (1996) were implemented to assess both the face-to-face and online courses' ability to support the needs of Self-Determination Theory (Deci & Ryan, 2008). Higher scores on this 24-item questionnaire indicated higher perception of needs being supported.

The Psychological Need Satisfaction in Exercise [PNSE] Scale was also used to assess needs satisfaction through 18 items on a 6-point Likert scale (McAuley et al., 1989). For this study, the word "exercise" was changed to "physical activity". Higher scores indicated higher need satisfaction. Three additional measures assessed needs satisfaction through a 7-point Likert scale with higher scores indicating higher need satisfaction. The use of these measures provided additional insight into each modality's capabilities for satisfying the needs of SDT. Autonomy satisfaction was examined through 6-items established by Standage et. al (Standage et al., 2005) Competency satisfaction was assessed through 5-items created by McAuley et al. (1989). Relatedness satisfaction was examined through the acceptance subscale of the Need for Relatedness Scale by Richer and Vallerand (1998).

Autonomous motivation for regular physical activity was assessed via the Index of Autonomous Functioning [IAF]. The IAF examined autonomy by assessing how likely individuals are to self-organize behaviors through 15 items on a 5-point Likert scale (Weinstein et al., 2012). Modifications to the measure included revising the instructions to focus attention on general experiences with physical activity. Higher scores indicated higher autonomous motivation for physical activity.

2.4. Intervention

The objective of the Physical Activity Course was to provide undergraduate students with knowledge, skills, and motivation to establish sustainable long-term physical activity behavior change. The course met either bi-weekly for 50 minutes, or weekly for 100 minutes. During classroom instruction time, students attended educational lectures, engaged in student-focused discussions, and in-class physical activities and exercises. Educational content covered ranged from the benefits of regular physical activity to aerobic and anaerobic exercise prescription. Educational content was delivered via lectures, discussions, and reading material. The reading materials were accessible to students via an online textbook. In-class activities included fitness walking, resistance training, group fitness, yoga, and lifetime sports such as basketball.

The course was instructed by graduate teaching assistants enrolled in the Kinesiology program at the university in which the physical activity course was conducted. Prior to the start of the course, graduate teaching assistants underwent a two-day training session where strategies to increase course effectiveness were covered. Throughout the duration of the course, graduate teaching assistants were supervised and coached on how to facilitate a needs-supportive environment through faculty supervision.

The primary competency strategy implemented focused on educating students on the benefits of regular physical activity and how physical activity could regularly be incorporated into one's lifestyle. This strategy was implemented through the use of textbook reading materials, reading quizzes, student-led discussions, and exams to assess student knowledge. Students' knowledge and awareness of the variety types of physical activity modalities that can be used to reach the recommended physical activity guidelines for health benefits by providing students with tours of available fitness facilities, providing students with scheduling information on the fitness classes, and the completion of fitness classes such as aerobic dance during class time.

The primary autonomy strategy implemented involved providing students with a choice in the physical activities they participated in. This involved having a choice in the types of in-class activities completed along with a choice in the types of out-of-class physical activity they completed for assignments. In instances where in-class activities were predetermined, the rationale for the activities being completed was provided

to students to demonstrate a linkage between course context and outcomes. Additionally, students were regularly asked for feedback throughout the course on the types of physical activities they would like to complete. Student feedback was then considered and incorporated as much as possible.

To address the theoretical construct of relatedness to physical activity and to others who are physically active, group cooperation and teamwork was regularly implemented in the course. In the first weeks of the course, students familiarized themselves with their classmates and their instructor through a variety of icebreaker physical activities. Throughout the remainder of the course, students participated in small group physical activities that required interaction with other students to achieve a common goal (i.e. win a game, complete a task, etc.). Additionally, teaching assistants regularly posted online announcements of encouragement, shared their own experiences with physical activity and exercise, and offered regular availability to assist students in the course.

2.5. Data Analysis

Statistical analysis was completed using SPSS (version 27). Descriptive statistics were used for demographic purposes. Repeated measure ANOVAs examined individual differences within each modality at each time point. A confidence interval of 95% was implemented. Effect sizes were observed through Cohen's *d*-value and classifications of effect sizes were based on previously posted guidelines (Cohen, 1988).

3. Results

3.1. Physical Activity

A one-way repeated-measures ANOVA was conducted to examine changes in total physical activity (MET-minutes/week) across three time points: baseline, midpoint, and endpoint. Post hoc comparisons indicated that total physical activity significantly increased from baseline ($3,927.25 \pm 3,121.19$) to midpoint ($4,483.61 \pm 2,997.75$; $p = .03$), and from baseline to endpoint ($4,804.17 \pm 3,522.93$; $p = .04$). No significant difference was found and total physical activity are presented in Table 2.

Table 2

Physical Activity Levels of Participants in MET Minutes per Week

	<i>Face-to-face</i>	
	<i>Mean</i>	<i>N</i>
Walking MET Minutes		
Baseline	1442.83±1146.74	108
Midpoint	1644.39±1208.66	100
Endpoint	1731.47±1260.51	96
Moderate MET Minutes		
Baseline	1110.73±1116.10	82
Midpoint	1284.52±1224.13	84
Endpoint	1215.42±1099.81	83
Vigorous MET Minutes		
Baseline	2334.88±1836.24	86
Midpoint	2362.38±1719.12	84
Endpoint	2627.95±2204.83	83
Total MET Minutes		
Baseline	3927.25±3121.19	114
Midpoint	4483.61±2997.75	105
Endpoint	4804.17±3522.93	101

3.2. Needs Support and Satisfaction

Separate repeated-measures ANOVAs were conducted to examine changes in perceived need support and need satisfaction across the three measurement points.

3.3.1. Competency

Competency support scores decreased significantly from baseline and endpoint ($df = 1$, $p < .001$). A significant decrease in competency support was also observed when comparing all time points ($df = 2$, $p = 0.04$). No significant changes were observed for competence satisfaction across time on either the PNSE

or McAuley et al. scales (all $p > .05$), although descriptive trends suggested slight increases on the McAuley et al. measure and decreases on the PNSE.

3.3.2. Autonomy

Perceived autonomy support did not significantly change across time. However, autonomy satisfaction significantly increased from baseline to endpoint on the Standage et al. measure ($df = 1$, $p = .05$).

3.3.3 Relatedness

No significant changes were observed in perceived relatedness support across time ($p < .05$). In contrast, relatedness satisfaction assessed by the PNSE significantly decreased from baseline to endpoint ($df = 1$, $p = .04$). Scored on the Need for Relatedness Scale also declined, though this change was not statistically significant ($p > .05$).

3.3.4. Autonomous Motivation for Physical Activity

Autonomous motivation was assessed using the Index of Autonomous Functioning. A repeated-measures ANOVA indicated no significant change in autonomous motivation across the semester ($p = .33$). Descriptive statistics are presented in Table 3.

Table 3

Autonomous Motivation for Physical Activity

	<i>Face-to-face</i>	
	<i>Mean</i>	<i>N</i>
Baseline	3.43±0.58	116
Midpoint	3.37±0.57	111
Endpoint	3.28±0.54	105

4. Discussion

This study examined the implementation of SDT-based instructional strategies within an undergraduate physical activity course and evaluated changes in physical activity behavior, psychological need support, satisfaction, and autonomous motivation across a 16-week semester.

4.1. Physical Activity

The significant increases in weekly physical activity observed align with international findings that theoretically-based interventions can meaningfully influence student engagement in physical activity (Ha et al., 2020; Juwono & Szabo, 2020). Recent large-scale analyses also reaffirm that structured course-based programs remain effective in increasing physical activity among university students even in diverse sociocultural contexts (Brown et al., 2024).

4.2. Needs Support and Satisfaction

The primary competency-promoting strategies implemented focused on educating students on how to engage in and the benefits associated with regular physical activity. The competency satisfaction and support results observed may be due to the primary competency strategy implemented revolving solely around physical activity education. A decline in competence support across the semester reflects consistent findings in recent systematic reviews demonstrating that physical activity interventions often produce only modest improvements in competence or physical self-perception among college students (Yang et al., 2024). The use of education as a strategy to increase competency is an ineffective strategy when it is the sole strategy used (Dishman & Buckworth, 1996; Juwono & Szabo, 2020). Other effective competency-promoting strategies such as cultivating a task climate and positive reinforcement of physical activity progression were not focal points of the course (Corella et al., 2019). Results would continue to support the literature that educational strategies alone are not enough to increase the competency of undergraduate students enrolled in a physical activity course, thus other competency promoting strategies should be used.

Autonomy satisfaction and support scores would suggest that the course was effective in facilitating an autonomy-supportive environment and satisfying the need for autonomy. This is likely due to the course's use of several autonomy-promoting strategies, including participant choice of in-class activities and opportunities to provide feedback on in-class activities. The implementation of these autonomy-promoting strategies has previously been shown to be effective (Corella et al., 2019; González-Cutre et al., 2018). Recent SDT-focused interventions demonstrated similar patterns, showing that autonomy is often the most

successfully supported the three SDT needs in instructional environments (Yang et al., 2024). Results continue to support the implementation of these autonomy-supporting strategies in physical activity courses for undergraduate students and other universities should consider incorporating these strategies to improve mental health and well-being in their student population.

The conflicting results between high relatedness support and decreasing satisfaction reflect emerging findings in studies examining university students in their social networks and physical activity contexts (Elmer et al., 2020; Huang et al., 2023). High relatedness support scores would align with previous research as the course implemented a variety of relatedness-promoting strategies that have previously yielded positive results (Corella et al., 2019; Ha et al., 2020). Despite the relatedness support scores, the course was unable to significantly increase relatedness satisfaction scores. Relatedness satisfaction reflects one's need to belong and a sense of connectedness to others (Ryan & Deci, 2000). SDT research shows that relatedness satisfaction to meaningful and sustained interpersonal connections, aside from group participation or cooperative tasks. It should be noted that the physical activity course observed occurred during the COVID pandemic and it is possible that external factors impacted the relatedness scores observed. Throughout the COVID pandemic, social interactions were restricted, causing undergraduate students to interact less with peers (Elmer et al., 2020). The conflicting relatedness support and satisfaction scores observed may be the results of external factors and thus would warrant further examination before any concrete conclusions can be made.

4.3. Autonomous Motivation for Physical Activity

The autonomous motivation for physical activity remained constant throughout the physical activity course, likely due to the course's struggle to facilitate an encompassing needs-supportive environment and poor needs-satisfaction results observed. Autonomous motivation is based on the fulfillment of all three needs (Deci & Ryan, 2000). Although a significant increase in autonomy satisfaction was observed, no other significant increases in needs satisfaction were noted. Furthermore, the course noted decreases on all need support scales used, with a significant decrease in scores being noted in competency support. Results would continue to support the importance of satisfying all three needs of Self-Determination Theory in order to facilitate autonomous motivation for regular physical activity thus these types of strategies should continue to be implemented into universities and colleges.

4.4. Strength and Limitations

This study was inclusive allowing for the impact of the course to be observed for both traditional and non-traditional students. There are limitations of the study which should be considered in future research. Although the course employed theoretically-based strategies focused on satisfying the needs of Self-Determination Theory, instructor meetings with supervising faculty members during the course primarily focused on the administration of the course. Future research should consider providing instructors with ongoing extensive training regarding the facilitation of need-supporting environments throughout the course rather than just at the beginning of the course. Along these lines, this study did not implement direct observations to assess how needs-supporting strategies were implemented. Without these observations, it may be difficult to draw concrete conclusions regarding the implementation of the strategies utilized. Future research should consider including direct observations to gain a better understanding of needs supporting strategies implemented within undergraduate physical activity courses.

5. Conclusions

The purpose of this study was to examine the effectiveness of theory-based behavioral modification strategies within a physical activity course for undergraduate students. The effectiveness of strategy implementation was based on the course's ability to increase students' levels of physical activity, facilitate a needs-supportive environment, and satisfy the needs of Self-Determination Theory. Additionally, the strategies implemented were examined to assess course capabilities to increase students' autonomous motivation for engaging in regular physical activity. Overall, the course successfully increased undergraduate students' physical activity levels. However, the strategies implemented failed to facilitate an encompassing needs support or needs-satisfying environment for undergraduate students. Resulting in autonomous motivation for physical activity to remain constant. This would suggest that the strategies intended to facilitate autonomous motivation for physical activity may have been ineffective, potentially limiting the course's ability to promote long-term physical activity behavior change (Deci & Ryan, 2000; Friederichs et al., 2015; Teixeira et al., 2012).

6. Implications

Physical activity has a myriad of health benefits, yet only 25% of the United States population meets physical activity and public health guidelines (CDC, 2024). The undergraduate college years provides an opportunity to empower young adults to learn more about physical activity to increase their physical activity. One such promising strategy is the inclusion of physical activity promotion courses as part of an undergraduate curriculum.

If the objective of undergraduate physical activity courses is to increase the number of college students that experience the benefits of regular physical activity, it is important to understand the strengths and limitations of these courses and how to adjust strategies implemented when necessary. This study ultimately supports the notion that undergraduate physical activity courses can increase physical activity levels of undergraduate students. However, the study also highlights the importance of implementing needs supportive strategies conducive to satisfying students' need for competency, relatedness, and autonomy. Without satisfying all three needs, as observed in this physical activity course, autonomous motivation for regular physical activity may remain constant (Deci & Ryan, 2000; Friederichs et al., 2015; Teixeira et al., 2012) thus limiting the likelihood that long-term engagement in physical activity will continue (Deci & Ryan, 2000, 2008; Teixeira et al., 2012). The use of physical activity courses can be an effective strategy to increase the physical activity levels of undergraduate students, however, employing courses that do not impact autonomous motivation for regular physical activity may not be the most effective way to facilitate sustained long-term adherence to the physical activity guidelines. Ineffective physical activity courses may ultimately diminish the likelihood that the increased physical activity levels noted in the courses do not translate beyond the course, thus limiting the number of undergraduate students who experience the positive health outcomes of regular physical activity. Furthermore, for course instructors, a two-day training may not be long enough and weekly reinforcements to course instructors may be needed for optimal outcomes. The current study calls attention to the need for physical activity courses to assess theoretical framework strategies implemented and address shortcomings of strategies if necessary.

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References

- Brown, C.E.B., Richardson, K., Halil-Pizzirani, B., Atkins, L., Yücel, M. & Segrave, R. A. (2024). Key influences on university students' physical activity: a systematic review using the Theoretical Domains Framework and the COM-B model of human behaviour. *BMC Public Health*, 24, 418. <https://doi.org/10.1186/s12889-023-17621-4>
- Chatzisarantis, N. L. D., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology & Health*, 24(1), 29–48. <https://doi.org/10.1080/08870440701809533>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). Lawrence Erlbaum Associates.
- Corella, C., Zaragoza, J., Julián, J. A., Rodríguez-Ontiveros, V. H., Medrano, C. T., Plaza, I., & Abarca-Sos, A. (2019). Improving physical activity levels and psychological variables on university students in the contemplation stage. *International Journal of Environmental Research and Public Health*, 16(22), 4368. <https://doi.org/10.3390/ijerph16224368>
- Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekkelund, U., Yngve, A., Sallis, J. F., & Oja, P. (2003). International physical activity questionnaire: 12-country

- reliability and validity. *Medicine & Science in Sports & Exercise*, 35(8), 1381–1395. <https://doi.org/10.1249/01.MSS.0000078924.61453.FB>
- Das, B. M., & Evans, E. M. (2014). Understanding weight management perceptions in first-year college students using the health belief model. *Journal of American College Health*, 62(7), 488–497. <https://doi.org/10.1080/07448481.2014.923429>
- 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(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: a macrotheory of human motivation, development, and health. *Canadian Psychology*, 49(3), 182–185. <https://doi.org/10.1037/a0012801>
- Dishman, R. K., & Buckworth, J. (1996). Increasing physical activity: A quantitative synthesis. *Medicine & Science in Sports & Exercise*, 28(6), 706–719.
- Elmer, T., Mepham, K., & Stadtfeld, C. (2020). Students under lockdown: Comparisons of students’ social networks and mental health before and during the COVID-19 crisis in Switzerland. *PLoS ONE*, 15(7), e0236337. <https://doi.org/10.1371/journal.pone.0236337>
- Flannery, M. E. (2023). *The mental health crisis on college campuses*. NEA.
- Friederichs, S. A., Bolman, C., Oenema, A., & Lechner, L. (2015). Profiling physical activity motivation based on self-determination theory: A cluster analysis approach. *BMC Psychology*, 3(1). <https://doi.org/10.1186/s40359-015-0059-2>
- González-Cutre, D., Sierra, A. C., Beltrán-Carrillo, V. J., Peláez-Pérez, M., & Cervelló, E. (2018). A school-based motivational intervention to promote physical activity from a self-determination theory perspective. *The Journal of Educational Research*, 111(3), 320–330. <https://doi.org/10.1080/00220671.2016.1255871>
- Ha, A. S., Lonsdale, C., Lubans, D. R., & Ng, J. Y. Y. (2020). Increasing students’ activity in physical education: results of the self-determined exercise and learning for fitness trial. *Medicine & Science in Sports & Exercise*, 52(3), 696–704. <https://doi.org/10.1249/MSS.0000000000002172>
- Huang, J., Lv, Q., & Zeng, X. (2025). The influence of social support and empowerment on physical exercise behavior in university students: A self-determination theory perspective. *Acta psychologica*, 257, 105086. <https://doi.org/10.1016/j.actpsy.2025.105086>
- Juwono, I. D., & Szabo, A. (2020). The efficacy of Self Determination Theory-based interventions in increasing students’ physical activity: A systematic review. *Physical Activity Review*, 8(1), 74–86. <https://doi.org/10.16926/par.2020.08.09>
- Maselli, M., Ward, P. B., Gobbi, E., & Carraro, A. (2018). Promoting physical activity among university students: a systematic review of controlled trials. *American Journal of Health Promotion*, 32(7), 1602–1612. <https://doi.org/10.1177/0890117117753798>
- McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the intrinsic motivation inventory in a competitive sport setting: a confirmatory factor analysis. *Research Quarterly for Exercise and Sport*, 60(1), 48–58. <https://doi.org/10.1080/02701367.1989.10607413>
- Ning, G. (2020). Influence of aerobics on modulation of depression and anxiety among college students. *Revista Argentina de Clínica Psicológica*, 29(1), 662. <http://dx.doi.org/10.24205/03276716.2020.88>
- Pauline, J. S. (2013). Physical activity behaviors, motivation, and self-efficacy among college students. *College Student Journal*, 47(1), 64–74.
- Quartirol, A., & Maeda, H. (2014). Self-determined engagement in physical activity and sedentary behaviors of us college students. *International Journal of Exercise Science*, 7(1), 87–97. <https://doi.org/10.70252/SVGJ1383>
- Richer, S. F., & Vallerand, R. J. (1998). Construction and validation of the need to belong scale. *European Review of Applied Psychology*, 48, 129–137.
- 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, T. G. (2021). Problem-based learning opportunities within Ontario (Canada) elementary health and physical education. *Journal of Pedagogical Sociology and Psychology*, 3(2), 66–74. <https://doi.org/10.3390/JPSP.2021270046>
- Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology*, 75(3), 411–433. <https://doi.org/10.1348/000709904X22359>

- Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 78. <https://doi.org/10.1186/1479-5868-9-78>
- U.S. Department of Health and Human Services. (2018). *Physical Activity Guidelines for Americans, 2nd edition*. Author.
- Vainshelboim, B., Bopp, C. M., Wilson, O. W. A., Papalia, Z., & Bopp, M. (2019). Behavioral and physiological health-related risk factors in college students. *American Journal of Lifestyle Medicine*. Scopus. <https://doi.org/10.1177/1559827619872436>
- Vaughn, M., Hur, J. W., & Russell, J. (2019). Flipping a college physical activity course: Impact on knowledge, skills, and physical activity. *Journal of Pedagogical Research*, 3(3), 87-98. <https://doi.org/10.33902/jpr.vi0.126>
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2012). The index of autonomous functioning: Development of a scale of human autonomy. *Journal of Research in Personality*, 46(4), 397-413. <https://doi.org/10.1016/j.jrp.2012.03.007>
- Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology*, 70(4), 767-779. <https://doi.org/10.1037//0022-3514.70.4.767>
- Yang, Z., Yang, Z., Ou, W., Zeng, Q., & Huang, J. (2024). Effects of physical activity interventions on physical self-perception in college students: a systematic review and meta-analysis. *Journal of Physical Activity & Health*, 21(10), 990-1007. <https://doi.org/10.1123/jpah.2024-0055>