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Development and Validation of a Motor Competence Self-Efficacy Scale for University Students

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Abstract

The purpose was to develop a motor competence self-efficacy scale for university students in various sports environments. The study encompassed a series of analytical steps, including (a) exploratory factor analysis (EFA), (b) confirmatory factor analysis (CFA), (c) reliability analysis, and (d) assessment of criterion validity. Using Sample 1 (n = 244), EFA was employed to explore the factorial structure. Then, CFA was completed with a new sample of 265 university students (Sample 2). Various fit indices, such as CFI, NNFI, and RMSEA, indicated that the two-factor structure (i.e., manipulative and non-manipulative skills) exhibited a good fit. In other words, the two-factor structure also demonstrated a moderate fit (NFI = .901, CFI = .913, RMSEA = .068). One-way MANOVA results revealed statistically significant differences among the exercise stages of change in self-efficacy for both manipulative and non-manipulative skills. In addition, multiple regression analyses showed that active participation in sports (self-report) and gender were significant predictors of both factors. BMI was found to be substantial for non-manipulative skills but not for manipulative skills. In conclusion, this self-efficacy scale provides reliable and valid scores for assessing motor competence self-efficacy among university students. Following additional validation studies, the Motor Competence Self-Efficacy Scale may serve as a valuable instrument for both instructors and researchers in assessing university students' self-efficacy beliefs.

Keywords: Confirmatory Factor Analysis, Exploratory Factor Analysis, Fundamental Motor Skills, Scale Development, Self-Efficacy

INTRODUCTION

Regular physical activity (PA) participation has many positive outcomes (Crozier & Spink, 2017). However, the participation rate in PA decreases significantly with age (Irwin, 2004). In order to increase the rate of PA, understanding which factors play an essential role in an active lifestyle is critical (Stodden & Goodway, 2007). One way to increase PA is to develop fundamental motor skills (FMS), which are considered the building blocks for activity participation throughout the

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lifespan (Gallahue et al., 2014). Fundamental motor skills are developed during school years and refined into sport-specific skills later in adulthood (Clark, 2005).

Research has evaluated an individual's perceived motor competence in the PE literature. Based on the findings, there is a positive relationship between perceived motor competence and PA (Izaskun et al., 2021), health-related fitness (Moss et al., 2020), self-reported PA (Sackett & Edwards, 2019), and healthy body weight (De Meester et al., 2020; Spessato et al., 2013a). These results suggested that one's perception might be an indicator of PA participation (e.g., Stodden et al., 2008).

The social cognitive theory claims that self-beliefs are essential in one's thoughts and behaviors (Bandura, 1986). According to Bandura (1994), self-efficacy is defined as "people's belief about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (p. 2). Self-efficacy regulates one's feelings, choice of action, and behaviors (Bandura, 1997). For instance, students with high self-efficacy tend to choose more challenging tasks than those with low self-efficacy (Pajares, 1997). Bandura (1997) hypothesized that one could develop self-efficacy through the "processing of diverse sources of efficacy information conveyed inactively, vicariously, socially, and physiologically" (p. 115). That is, successful enactive experiences, observing others succeed, encouraging and positive feedback from others, and recognizing ways to manage emotions may boost self-efficacy.

In the literature, various studies were conducted to evaluate perceived motor competence in childhood (Barnett et al., 2015; Dreiskaemper et al., 2018; Harter, 1982; Pérez & Sanz, 2005; Rudisill et al., 1993), in adolescents (Maïano et al., 2008; McGrane et al., 2016), and in adulthood (Jiménez-Díaz et al., 2018). However, only a few of these studies were conducted with young adults. Additionally, studies have focused on perceived competence in sports-specific activities such as soccer (Forsman et al., 2016), swimming (Starek & McCullagh, 1999), basketball (Wang et al., 2013), and aquatic skills (D'Hondt et al., 2021). For instance, a sample item from the Perceived Competence in Basketball measure reads, "I feel able to meet the challenge of playing basketball." Apart from sports-specific measures of perceived competence, researchers (McGrane et al., 2016) preferred to assess only specific skills, such as "catching a tennis ball with two hands." However, no existing scale assesses FMS across different environments (e.g., martial arts, basketball, or running). Furthermore, a significant body of research reported that only 20% of articles provided evidence for the reliability and validity of measurements of perceived motor competence (De Meester et al., 2020).

While FMS are widely regarded as the building blocks for PA, their importance extends beyond childhood. In young adulthood, motor competence self-efficacy might play a critical role in fostering continued PA engagement, particularly in diverse sports and recreational settings that are common in university environments. University students often encounter opportunities to participate in various physical activities that require competency in FMS, such as intramural sports or recreational classes. A lack of self-efficacy in executing these skills may limit participation, potentially impacting the overall PA levels of students. Therefore, developing a tool to assess motor competence self-efficacy in university students is not only relevant but also crucial for identifying gaps in self-efficacy and designing interventions to promote lifelong PA.

Thus, this study aimed to develop an assessment tool to evaluate motor competence self-efficacy among university students across various sports environments, while providing psychometric evidence. It is necessary to recognize that self-efficacy is task-specific rather than a generalized sense of competence. In this context, motor competence self-efficacy is defined as individuals' confidence in their ability to carry out motor or physical tasks effectively.

METHODS

Participants

Convenience sampling, which is often employed when random sampling is difficult (Fraenkel et al., 2012), was used in this study with two different samples. The data from Sample One were gathered in the 2019-2020 academic year and used for exploratory factor analysis. As for the data of Sample Two, they were gathered in the fall semester of the 2022-2023 academic year and used for confirmatory factor analysis.

There is considerable variation in the literature regarding appropriate sample sizes for factor analysis. Kline (2014) suggested that a minimum of 100 participants is required. However, Comrey and Lee (2013) provided a more nuanced interpretation, stating that a sample size of 100 is considered poor, 300 is good, and 1000 is excellent. Fixed recommendations for sample size may not be suitable in all contexts, as sample adequacy can depend on the homogeneity of the sample's characteristics. Specifically, if the sample is heterogeneous, a larger sample size may be necessary; conversely, greater homogeneity may allow for smaller sample sizes (MacCallum et al., 1999; Mundfrom et al., 2005). Furthermore, it is commonly recommended that the sample size be between 3 and 20 times the number of variables/items (Mundfrom et al., 2005) or between 100

and 1000 participants (Comrey & Lee, 2013). In the present study, a sample size approximately 10 times the number of items was used, aligning with these general guidelines.

Sample One

The first sample was 244 voluntary university students from the faculty of education. The participants' ages range from 18 to 42 (*Mage* = 22.59, *SD* = 3.46, *Mheight* = 169.12, *SD* = 8.87, *Mweight* = 64.08, *SD* = 13.62, *Mbmi* = 22.26, SD = 3.46). The sample comprised 178 females and 64 males; one did not state that most students (*n* = 187) reported not regularly participating in PA. Only 25 of them were licensed players.

Sample Two

The second sample consisted of 265 voluntary university students (165 females, 98 males, and two non-binary) from the same faculty whose ages range from 17 to 42 (*Mage* = 21.88, *SD* = 2.92, *Mheight* = 170.55, *SD* =9.42, *Mweight* = 66.60, *SD* = 15.27, *Mbmi* = 22.70, *SD* = 3.70). More than half of the participants (64.9%, *n* = 172) stated that they do not regularly participate in PA and have no sports license (*n* = 219).

Ethical Considerations

The principles of the Declaration of Helsinki were followed in this research. Before data collection, permission was obtained from the university's Human Research Ethics Committee (484-ODTU-2019, 0477-ODTÜİAEK-2022). All participants were informed about the study. No participants were obligated to complete the scale. All data were kept safe and secure, and anonymized.

Procedure

Data were collected using the paper-and-pencil method for sample 1 and via the online method for sample 2. Students who agreed to participate were invited to complete the scale outside their regular class time, such as during break or lunch.

Data Collection Tools

The scale was designed to measure the motor competence self-efficacy of university students. During the development process, certain steps were followed. First, Bandura's (1997) guide was used to construct a self-efficacy scale. Then, a literature review in the area of motor development was undertaken to check previous research about perceived motor competence (e.g., Barnett et

al., 2015; Dreiskaemper et al., 2018; Forsman et al., 2016; McGrane et al., 2016; Martinek et al., 1978; Pérez & Sanz, 2005; Rudisill et al., 1993; Wang et al., 2013).

Furthermore, existing scales were examined. Some of them were developed as sports-specific, such as motor competence in basketball (Wang et al., 2013) and motor competence in football (Forsman et al., 2016). Most of them are two-dimensional, with different types of dimensions such as lower and upper body (Rudisil et al., 1993), as locomotor and object control (Barnett et al., 2015; Dreiskaemper et al., 2018; McGrane et al., 2016), as fine and gross (Pérez & Sanz, 2005). Although several studies considered FMS to comprise two factors, Gallahue et al. (2014) suggested that stability skills constitute a third factor of FMS.

Based on the literature review of motor development, several studies on perceived motor competence were identified as stated above. However, none specifically developed or validated a scale for university students. Therefore, instead of creating a predefined pool of articles, we reviewed the available literature to highlight this gap and justify the uniqueness of our scale.

As a result, an item pool was generated for three factors (locomotor, manipulative, and stability skills). Sample items from each factor include: "How good are you in long-distance (5000m) running?", "How good are you at pushing in some sports (such as wrestling and judo)?", "How much control can you maintain when bouncing the ball with your hand?" For the response format, a 9-point rating scale was selected (1 = "very poorly," 9 = "very well") because Bandura (1994) recommended against using too few steps.

For content validation, three experts in the PE field and one in measurement were asked to assess the quality of each item, verify its alignment with the corresponding factor, and provide further suggestions. In addition to these four experts, a linguistics expert reviewed the grammar and clarity of the scale developed in Turkish. The final version of the scale was tested with a cognitive interview with one university student. Cognitive interviews have been used to clarify and reorganize scale questions since the 1980s (Beatty & Willis, 2007), thereby increasing the validity and reliability of the scale (Desimone & Le Floch, 2004). In the cognitive interview process, the concurrent think-aloud method was used. In this method, the interviewee (who had a PhD in the PE field) is expected to express their thoughts while answering questions (Beatty & Willis, 2007). During the interview, not only item clarity but also the scale format were asked about. The interview lasted for forty-five minutes. After four experts reviewed the clarity of the scale and all

items were clear to the interviewee during the cognitive interview, no further interviews were conducted with another sample.

In addition to the motor competence self-efficacy scale, the exercise stage of the change instrument (Marcus & Lewis, 2003; Cengiz et al., 2008) was included in the survey. It consists of four questions about one's current participation behavior in PA. Based on the answers, a person is categorized into one of the five stages: pre-contemplation, contemplation, preparation, action, and maintenance. Moreover, data were gathered by the demographic form, which comprises (a) gender, age, height, and weight, (b) whether students participate in an activity regularly or not (the answer is yes or no), and (c) whether they have a sports license or not (the answer is yes or no). The criteria for "participation in an activity regularly" were based on the World Health Organization (2020). Additionally, the meaning of regular physical activity was stated in the "Stage of Change" instrument.

Data Analysis

Data analysis consists of the following steps:

a) *Exploring the factor structure of motor competence self-efficacy to reveal the factor structure of the scale through EFA*. In this step, the analysis was conducted to identify the factors and examine the relationships between the items and the factors. Prior to the analysis, Skewness and Kurtosis tests, Q-Q plots, and histograms were used to assess univariate normality for each item. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity were performed. To determine the number of factors, the following criteria were utilized: eigenvalues greater than one, the scree plot, and the interpretability of the pattern matrix. Reliability analysis was conducted for each factor.

b) *Cross-validating via CFA*. Model fit valued using multiple indices, comparative fit index (CFI), the non-normed fit index (NNFI), and the root mean square error of approximation (RMSEA), as well as Chi-square statistics, were considered.

c) *Estimating each factor's internal consistency reliability coefficients*. Both Cronbach's alpha and McDonald's omega were reported.

d) *Providing further validity evidence using one-way MANOVA and multiple regression analysis*. For the one-way MANOVA, univariate normality was assessed using histograms, 5% trimmed means, skewness and kurtosis values, and the Kolmogorov–Smirnov and Shapiro–Wilk tests. Bivariate normality was examined through scatterplots. To assess the absence of multicollinearity among the dependent variables, Pearson's correlation

coefficients (r) were considered. The homogeneity of the variance–covariance matrix was evaluated using Box's Test of Equality of Covariance Matrices. In contrast, Levene's Test of Equality of Error Variances was used to assess the homogeneity of variances. For the Multiple Regression, the normality of residuals was assessed using histograms and P–P plots. The absence of multivariate outliers was evaluated through Cook's Distance and standardized DFBETA values. Multicollinearity was examined using tolerance and Variance Inflation Factor (VIF) values. The independence of errors was assessed using the Durbin–Watson statistic. A comparison of self-efficacy across different exercise stages was conducted. Students in the active stages are expected to exhibit higher self-efficacy than those in the inactive stages. For the multiple regression analysis, BMI, gender, and self-reported activity status were included as predictor variables. It is hypothesized that boys, participants with low BMI, and participants who reported being active will have higher self-efficacy scores across each factor. The alpha level was set at .05.

Hypothesis for One-Way MANOVA

H_0: There are no statistically significant differences in the linear combination of the dependent variables (manipulative and non-manipulative skills self-efficacy) across the exercise stages of change among university students.

Hypothesis for Multiple Regression Analysis

H_0: $\beta_1 = \beta_2 = \beta_3 = 0$ (for each dependent variable)

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS) and the Analysis of Moment Structures (AMOS).

RESULTS

Exploratory Factor Analysis with Sample One

The motor competence self-efficacy scale, comprising 24 items, was administered to 244 voluntary university students. Subsequently, an exploratory factor analysis was conducted using principal axis factoring, and oblique rotation (specifically, direct oblimin) was employed to examine the factorial structure of the data. Before conducting the EFA analysis, the correlation matrix, Kaiser-Meyer-Olkin (KMO) value, and Bartlett's test of sphericity were examined to check the appropriateness of the data. The result of Bartlett's test of sphericity was significant (BTS value = 2809.96, $p < .05$), and the KMO value was .90, indicating the appropriateness of the data for factor

analysis (Tabachnick & Fidell, 2007). Four factors emerged with eigenvalues greater than 1. However, two items, including the words "martial arts" ("How good are you at pushing movement in martial arts?" and "How good are you at dodging skills in martial arts?"), appeared as a factor. Thus, the analysis was rerun with all items, limiting the number of factors to three and assuming the hypothesized three-factor structure (locomotor, manipulative, and stability skills). The pattern matrix is presented in Table 1. The first factor has eight items (accounting for 43.7% of variance). It includes items related to self-efficacy for locomotor skills such as "long distance (5000m) running," "jumping with both feet without stopping," and "one-leg leap forward." Factor loadings ranged between .739 and .541. The second factor, explaining 9.69% of the variance, included eight items with factor loadings ranging from .810 to .426. It includes items such as "hitting a football" and "bouncing the ball with both hands." It was called self-efficacy for manipulative skills. The third factor (accounting for 6.27% of variance), named self-efficacy for stability, included four items (e.g., "pulling oneself," "doing swing movement in sports like gymnastics") with factor loadings ranging from .851 to .454. However, four items appeared with the items related to locomotor rather than stability. These items were retained for the second phase of the study. Two approaches were used for internal consistency: Cronbach's alpha and McDonald's Omega (ω). Alpha coefficients were .91 for locomotor, .89 for manipulative skills, and .87 for stability, while McDonald's Omega (ω) suggested by Hayes and Coutts (2020) were .91 for locomotor, .89 for manipulative, and .87 for stability.

Confirmatory Factor Analysis with Sample Two

Confirmatory factor analysis (CFA) was conducted to test the three-factor model of the motor competence self-efficacy scale in an independent sample. Before running the analysis, the multivariate normality assumption was checked using Kline's (1998) recommendation. According to the recommendation, multivariate normality was checked by using a univariate distribution. A skew index greater than 3 and a kurtosis index greater than 10 may indicate possible problems with univariate normality. As a result, no violations were noted. While evaluating the model, multiple indicators were used, as Hoyle (1995) recommended. Thus, the comparative fit index (CFI), the non-normed fit index (NNFI), and the root mean square error of approximation (RMSEA), as well as Chi-square statistics, were considered. The CFI and NNFI are classified as incremental fit indices as they assess the amount of improvement in fit by comparing the target model to a more restricted baseline model. Values greater than .95 show an adequate model fit (Kline, 1998). In addition to CFI and NNFI, the RMSEA is an example of an absolute fit index. The value of RMSEA is interpreted as follows: values below .05 indicate a close fit, between .05 and

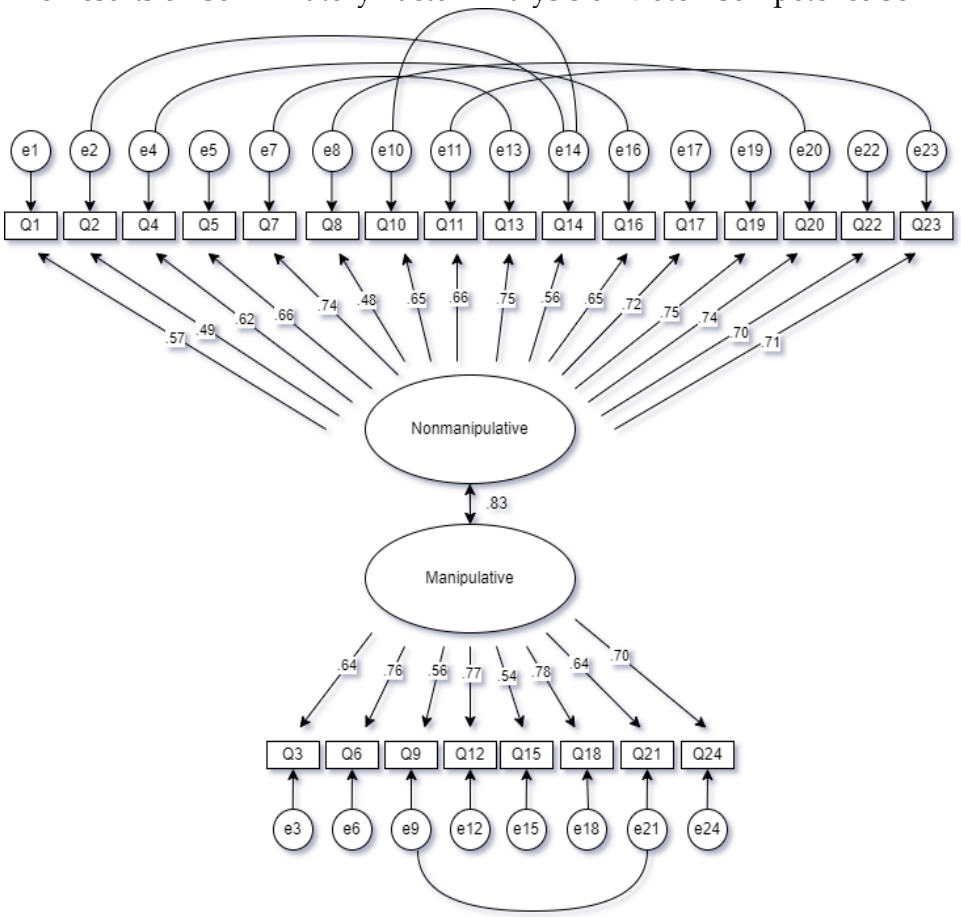
.08 indicate a mediocre fit, and values above .10 indicate a poor fit (Browne & Cudeck, 1993). All fit indices (NFI = .901, CFI =.913, RMSEA = .069) indicate a mediocre fit for the three-factor model when item 2 was deleted. Although all items, except item 2, loaded well onto their corresponding factors, the correlation between the stability and locomotor factors was higher than expected (r = .97). Therefore, a two-factor model was tested while keeping all items. Results indicated that the two-factor structure also provided a moderate fit (NFI = .901, CFI = .913, RMSEA = .068), with seven correlated error terms identified by the modification indices. As shown in Figure 1, all pattern coefficients were in the range of .48 to .78. More specifically, coefficients range from .54 to .78 for manipulative skills with eight items and from .48 to .75 for non-manipulative skills with 16 items. Standardized coefficients, along with confidence intervals, were presented in Appendix A. In addition, the correlation between the efficacy of manipulative and non-manipulative skills was .83 (95% CI [.743, .894]).

Table 1
Pattern Matrix

	Factors		
Questions	**Locomotor skills**	**Manipulative skills**	**Stability/Balance Skills**
Q2	**.739**	.089	.099
Q14	**.685**	-.048	-.075
Q15	**.683**	-.068	-.189
Q4	**.621**	-.015	-.024
Q1	**.617**	.026	-.043
Q3	**.612**	.136	.080
Q16	**.599**	.010	-.198
Q13	**.541**	.165	-.125
Q12	-.147	**.810**	-.081
Q10	.060	**.752**	.064
Q23	.047	**.748**	.003
Q11	.114	**.699**	.114
Q24	-.124	**.669**	-.202
Q9	.144	**.621**	.061
Q22	.145	**.601**	-.002
Q21	.085	**.426**	-.172
Q20	.035	.076	**-.851**
Q8	.070	.008	**-.775**
Q18	.242	.073	**-.565**
Q6	.200	.129	**-.454**

Note. The order of the items was rearranged for the second administration.

Figure 1
The Results of Confirmatory Factor Analysis of Motor Competence Self-Efficacy



Note. The order of the items was rearranged for the second administration.

Reliability analysis with Sample 2

Two approaches, Cronbach's alpha and McDonald's Omega (ω), were used for reliability. Alpha coefficients were .92 for non-manipulative and .87 for manipulative skills, .94 for all items, while McDonald's Omega (ω) suggested by Hayes and Coutts (2020) were .87 for manipulative, .93 for non-manipulative skills, and .94 for all items. Cronbach's alpha is the most widely used measure, but it assumes equal factor loadings, whereas McDonald's Omega provides a more accurate estimate when this assumption is not met. Therefore, both were reported. A suggested rule of thumb is that reliability should be at least .70 and preferably higher (Fraenkel et al., 2012).

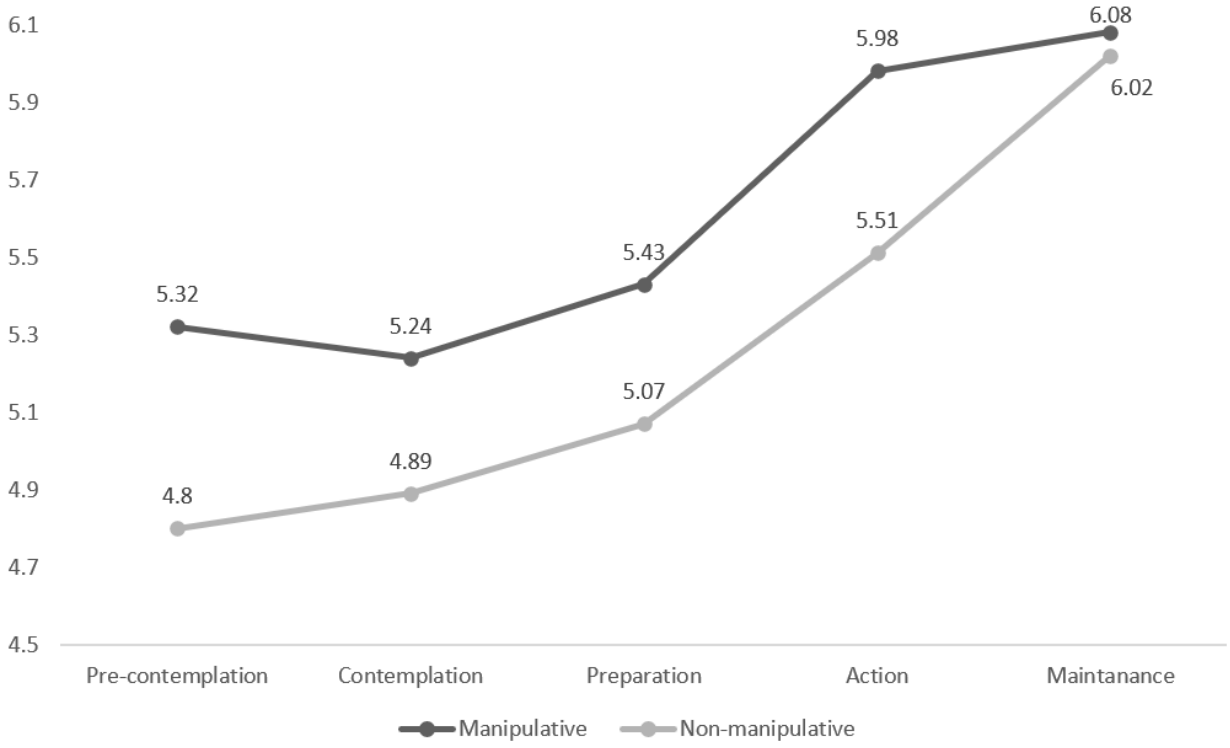
Further validation

Multivariate analyses were conducted to provide further validation evidence. Before running these analyses, assumptions were checked, including multivariate normality, absence of

multicollinearity, homogeneity of variance, homogeneity of variance-covariance matrices, linearity, and normality of residuals. No serious violations were noted.

First, a one-way MANOVA test was used to check the relationship between motor competence self-efficacy and the exercise stage of change behavior among university students. The dependent variables were two factors of self-efficacy, while the independent variable was the exercise stage of change. The exercise stage of change has five stages: pre-contemplation, contemplation, preparation, action, and maintenance. Descriptive results showed that the average self-efficacy score was 5.27 (*SD*= 1.40) for non-manipulative and 5.59 (*SD*= 1.49) for manipulative skills. Based on the exercise stage of change, students in the maintenance stage had the highest self-efficacy score, followed by those in the action, preparation, contemplation, and pre-contemplation stages. Figure 2 shows the self-efficacy score based on the exercise stage of change for two factors.

Figure 2
University Students' Efficacy for Manipulative and Non-manipulative Skills Based on the Exercise Stage of Change Classification



Results of the one-way MANOVA showed that there was a significant main effect for exercise stage of change (Wilks' Λ =.861, $F(8, 518) = 5.028$, $p < .001$, $\eta 2 = .072$). Based on Cohen's standard (1988), the multivariate η2 of .072 is considered a medium effect. Follow-up univariate tests (with Bonferroni correction) indicated a statistically significant difference among the exercise stages of

change on self-efficacy for manipulative skills, $F(4, 260) = 4.187$, $p = .003$, $\eta 2 = .061$. The Scheffe test showed that students in the maintenance stage ($M = 6.09$, $SD = 1.57$) were statistically more efficacious than those in the contemplation stage ($M = 5.23$, $SD = 1.42$). Also, there was a statistically significant difference between the exercise stages of change on self-efficacy for non-manipulative skills, $F(4, 260) = 9.780$, $p < .001$, $\eta 2 = .131$. The Scheffe test revealed that students in the maintenance stage ($M = 6.02$, $SD = 1.41$) exhibited significantly greater self-efficacy scores compared to students in the pre-contemplation stage ($M = 4.80$, $SD = 1.45$), contemplation stage ($M = 4.88$, $SD = 1.18$), and preparation stage ($M = 5.07$, $SD = 1.21$).

Second, two separate simultaneous multiple regression analyses were employed, with outcome variables being self-efficacy for manipulative and non-manipulative skills. Alpha was set at .025. For each analysis, BMI, gender, and self-reported PA were entered into the equation at the same step. Findings are presented in Table 2. Both regression models were significant, explaining 16.9% and 26.1% of the variance for manipulative and non-manipulative skills, respectively. For non-manipulative skills, all three predictors were statistically significant: BMI ($b = -.06$, $t = -2.75$, $p < .006$, 95% CI [-.10, -.02]), gender ($b = -1.04$, $t = -6.30$, $p < .001$, 95% CI [-1.37, -.72]), and PA status ($b = -.88$, $t = -5.35$, $p < .001$, 95% CI [-1.20, -.56]). Male participants, students who perform sports actively, and those with a lower BMI were more efficacious in non-manipulative skills. On the other hand, for manipulative skills, BMI ($b = -.02$, $p = .395$, 95% CI [-.07, .03]) was not significant, while gender ($b = -1.03$, $t = -5.513$, $p < .001$, 95% CI [-1.40, -.67]) and PA status ($b = -.53$, $t = -2.826$, $p < .005$, 95% CI [-.89, -.16]) were significant. That is, male participants and active participants demonstrated greater self-efficacy in manipulative skills.

Table 2
Summary of Simultaneous Regression Analyses

	Regression 1					**Regression 2**				
	Outcome variable: non-manipulative skills					**Outcome variable: manipulative skills**				
Predictor	***b***	***SE b***	***β***	***t***	***sr²***	***b***	***SE b***	***β***	***t***	***sr²***
Gender	-1.04	.17	-.37	-6.30*	.131	-1.03	.19	-.34	-5.51*	.10
Activity status	-.88	.16	-.30	-5.35*	.028	-.53	.19	-.17	-2.83*	.002
BMI	-.06	.02	-.16	-2.75*	.098	-.02	.02	-.05	-.85	.029
Model significance	F (3, 261) = 30.801, p < .001					*F* (3, 261) = 17.712, *p* < .001				

Note. * $p < .025$

DISCUSSIONS

A motor competence self-efficacy scale was developed for university students across various sports environments. First, EFA ($n = 244$) was used to examine the underlying factor structure and

to refine the scale. Then, CFA (n = 265) was employed to determine whether the data confirmed the model. However, because two of the factors that emerged in the EFA exhibited a very high correlation, a two-factor model was tested. According to the CFA analysis, all pattern coefficients for the manipulative and non-manipulative skills factors were high. The two-factor model showed a moderate fit ($\chi 2$ (244) = 544.661, NFI = .901, CFI = .913, RMSEA = .068). Our findings provided a single piece of evidence for the construct validity of the motor competence self-efficacy scale with university students. In addition, reliability was estimated both by Cronbach's alpha and McDonald's Omega (ω). They were deemed acceptable. The motor competence self-efficacy scale might enable researchers to assess self-efficacy beliefs in university students. Overall, the 24-item scale was found to measure two factors of motor competence self-efficacy as follows:

- Self-efficacy manipulative skills (3, 6, 9, 12, 15, 18, 21, 24)
- Self-efficacy non-manipulative skills (1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23)

Although three factors, as suggested by Gallahue and colleagues (2014), were initially considered, a two-factor structure emerged for university students in this study. While many researchers (e.g., Burton & Miller, 1998; Barnett et al., 2015) have considered FMS as two factors, Gallahue et al. (2014) argued for a third factor—stability/balance—since skills like pulling and pushing do not fit neatly into locomotor or manipulative/object control categories. In this research, stability/balance did not emerge as a distinct factor, and this might be attributed to several factors: (a) university students might not have adequately acquired FMS, resulting in their responses not differentiating between skills, (b) skills are not presented in isolation; for example, a forward roll involves both locomotor and stability components, making categorization complex. It may be classified as a stability skill due to the need to maintain balance during execution (Gallahue et al., 2014), (c) as Gallahue and colleagues (2014) asserted "stability/balance is the most fundamental of three categories of movement because all voluntary movement involves an element of stability" (p.140). Thus, the differentiation of skills within the movement concept may prove to be a challenging task for a person who lacks specialization in motor competence. Similar findings were stated in the PE literature. For instance, studies have considered FMS in two categories (e.g., Barnett et al., 2015; Dreiskaemper et al., 2018) or focused on specific sports, such as soccer or swimming (e.g., D'Hondt et al., 2021; Forsman et al., 2016). This finding raises important considerations for both assessment and educational practice. While motor competence is theoretically structured into three distinct domains, university students may perceive these domains as more integrated, or their responses may not reflect the three domains. This finding highlights the need to re-examine how motor competence is taught in PE settings. Additionally,

educators may need to provide more explicit instruction and experiences that distinguish between locomotor, object control, and balance skills to help students recognize them, especially in the early years of school. From an assessment perspective, it suggests that measurement tools may need to account for how students conceptualize motor skills, rather than relying solely on expert-driven categorizations.

For criterion validity, students' motor competence self-efficacy was compared across exercise stages of change. Findings revealed that students' self-efficacy scores increase as they become more active. In non-manipulative skills, the relationship was linear. On the other hand, there was a distinct difference between active stages (i.e., action and maintenance) and inactive stages (i.e., pre-contemplation, contemplation, and preparation) in manipulative skills. In the literature, Ersöz (2017) found that participants' general self-efficacy scores were higher in the maintenance and action stages than in the pre-contemplation, contemplation, and preparation stages among university students. Another study showed that PA self-efficacy directly affected exercise stages of change in young adults (Lee & Young, 2018). Moreover, existing literature has consistently highlighted a significant relationship between self-efficacy and various forms of PA and exercise participation, suggesting that individuals with higher levels of self-efficacy are more likely to engage in and maintain active lifestyles (e.g., Ren et al., 2020; Reide et al., 2023; Sheng et al., 2025). These findings provide further evidence supporting the connection between self-efficacy in motor competence and students' engagement in PA. The observed pattern—where self-efficacy increases as students move into more active stages of change—reinforces the idea that high self-efficacy in one's motor abilities may play a significant role in maintaining an active lifestyle. Additionally, the more distinct gap observed in manipulative skills between inactive and active stages may indicate that these skills require a threshold level of PA activity engagement before self-efficacy meaningfully improves. This implies that specific skill domains may respond differently to changes in PA behavior. For educators, these findings highlight the importance of building self-efficacy in motor competence, particularly in the earlier stages of behavior change, as a potential strategy for promoting long-term PA adherence. Moreover, examining the relationship between self-efficacy in motor competence and PA readiness would suggest that interventions targeting both self-efficacy and skill development may be especially effective for university students.

Multiple regression analyses indicated that BMI was a significant predictor of self-efficacy for non-manipulative skills but not for manipulative skills. While there was a lack of information for young adults in the literature, perceived motor competence (De Meester et al., 2020; Duncan et al., 2017; Duncan et al., 2019; Spessato et al., 2013a) revealed statistically significant but negative

correlations with BMI in children and college athletes (Waite, 2024). In addition to these studies, a systematic review stated that the relationship between motor competence and BMI remains unclear, despite the long-term health consequences of motor competence (Slotte et al., 2017). Our results partially align with these findings, suggesting that higher BMI may negatively impact confidence in performing specific motor skills. However, the lack of association between BMI and self-efficacy for manipulative skills suggests a skill-specific dynamic, indicating that not all movement domains are equally affected by body composition. This observation refines earlier work by highlighting that the relationship between physical self-perceptions and BMI may vary across different types of motor skills and ages. For future research, these results point to the need for longitudinal studies that examine causal pathways among BMI, self-efficacy in motor competence, and PA behaviors across age groups.

Another finding concerned the relationship between active participation and self-efficacy. The results showed that active participation significantly predicted efficacy for both manipulative and non-manipulative skills. Similar findings have been reported in the literature (e.g., Sackett & Edwards, 2019; Vedul-Kjelsås et al., 2011). Additionally, these results align with Bandura's Social Cognitive Theory (1997), which emphasizes mastery experiences as a primary source of self-efficacy development. When individuals actively engage in learning tasks, they are more likely to gain positive experiences that reinforce their belief in their ability to perform those tasks successfully. In the context of PE, this suggests that students who are more actively involved in skill-based activities develop stronger self-efficacy in performing those skills. Moreover, the findings support the idea that PA engagement contributes not only to physical competence but also to psychological outcomes such as self-efficacy, as suggested by Ren et al. (2020), Reide et al. (2023), and Sheng et al. (2025). This connection reinforces the reciprocal relationship between self-efficacy and PA participation described in the literature, in which increased participation enhances self-efficacy, which in turn promotes continued engagement. For future research, these results suggest the need to explore how different types of active participation (e.g., peer-led activities, cooperative learning, or game-based formats) influence self-efficacy across diverse populations. Longitudinal studies could further clarify the directionality of the relationship and the long-term effects of active engagement on physical and psychological development in youth.

Multiple regression analysis was conducted to examine gender differences in motor competence self-efficacy. Results indicated that male students have higher self-efficacy for motor competence in both non-manipulative and manipulative skills. In the literature, boys (sixth grade) are considered more athletic by themselves (Vedul-Kjelsås et al., 2011). This might be the reason why

boys are more physically active than girls (Bakalár et al., 2019; Guthold et al., 2020; Schlund et al., 2021) and have high levels of actual motor competence (Adank et al., 2018; den Uil et al., 2023; Taş & Hürmeriç-Altunsöz, 2021; Spessato et al., 2013b; Zheng et al., 2022) in childhood and adolescent years. These results reinforce the well-established link between self-efficacy and motor behavior, while also highlighting persistent gender disparities in PA engagement (e.g., Guthold et al., 2020; Schlund et al., 2021). From a practical and policy perspective, these findings underscore the need for targeted interventions to enhance motor competence self-efficacy, especially among girls, through inclusive and supportive PE environments. Future research should explore the underlying sociocultural and environmental factors contributing to these disparities and examine how self-efficacy can be systematically developed across diverse populations.

The Strengths and Limitations

This study has several strengths. It represents the first attempt to develop a motor competence self-efficacy scale specifically for university students. The scale was designed to explore how familiar university students are with different motor skills and their application in various sports contexts—for example, kicking in football, catching a ball in team sports, or pushing in martial arts. This approach may provide insight into the extent to which students can engage in a variety of PA and help to assess whether they are physically literate. However, several limitations should be acknowledged for future studies. Firstly, the sample is limited to the faculty of education in Ankara. Further validation with diverse populations is warranted. Another limitation is that the scale assesses self-efficacy rather than the actual level of motor competence. Future research could examine the relationship between individuals' actual activity levels and their self-efficacy beliefs.

CONCLUSION

The Motor Competence Self-Efficacy Scale, developed for university students, has the potential to fill a gap in the existing literature. It is important for several reasons: (a) the motor competence self-efficacy scale might serve as a valuable predictor of university students' PA status, (b) there is a lack of research about motor competence self-efficacy of university students, and (c) limited research provided validity and reliability information regarding the scale (e.g., De Meester et al., 2020). This scale can contribute to a better understanding of how confident university students are in their motor competence.

PRACTICAL IMPLICATIONS

This study presents the development and validation of the Motor Competence Self-Efficacy Scale, designed to measure university students' self-efficacy in performing motor competence across various sports environments. This may have practical implications for researchers who design courses for university students. For instance, this scale might help identify students' levels of motor competence and enable researchers/instructors to design targeted interventions that enhance motor competence and encourage students to participate in PA throughout their lifespan. Additionally, this tool offers psychometric benchmarking for researchers studying the relationship between self-efficacy and motor development.

Beyond university-level instruction, the scale can also be integrated into broader sports education practices and schools. For example, in school settings, the scale results can be used by teachers or instructors to highlight the importance of the motor competence dimensions. They might provide differentiated skill drills, such as simplified ball-handling activities, and more complex sport-specific drills when students learn.

For the extracurricular activities, coaches can use the scale to tailor warm-ups and skill sessions to address areas where participants feel less competent, promoting greater motivation and retention in programs. Overall, this study contributes to both theoretical and applied knowledge in motor competence research, providing a foundation for future research and practical application in PE courses.

Authors' Contribution

Both authors jointly conceptualized the study and designed the methodology. First author led the idea, scale development, data collection and analysis, while second author follow the developmental process and contributed to the development of the self-efficacy scale and its validation. Both authors collaborated on writing and revising the manuscript and approved the final version for submission.

Declaration of Conflict Interest

We declare that there is no conflict of interest.

Ethics Statement

Permission was obtained from the Human Research Ethics Committee at Middle East Technical University (484 ODTÜ 2019, 0477-ODTÜİAEK-2022).

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