**Computational Thinking Skills and Computational Self-Efficacy as Predictors of Academic Well-Being**

**Abstract**

This study aimed to identify the levels of computational thinking skills, computational self-efficacy, and academic well-being among students, identify the potential relationships among them, and determine the predictive effects of computational thinking skills and computational self-efficacy on academic well-being. The study used the following tools: the Computational Thinking Skills Scale, the Self-Efficacy Scale, and the Academic Well-Being Scale. The study adopted a quantitative correlational predictive approach. The sample consisted of 280 students at the Faculty of Specific Education - Mansoura University. The study revealed that there is an average level of computational thinking skills, computational self-efficacy, and academic well-being. There is also a statistically significant relationship between computational thinking skills, computational self-efficacy, and academic well-being among students. In addition, computational thinking skills and computational self-efficacy are good predictors of academic well-being. Finally, the study presented a set of recommendations and suggestions.

**Keywords:** Computational Thinking Skills; Computational Self-Efficacy; Predictors of Academic Well-Being; Students

**Introduction**

The insertion of digital technologies into the educational field is a cultural process, and it forms part of an individual’s culture (Grover & Pea, 2013; Yen et al., 2012). Accepting learners as digital citizens requires them to acquire different patterns of thinking, such as innovative and critical thinking, complex problem solving, and computational thinking (Richado et al., 2023; Rich et al., 2021; Moore et al., 2020; Hou et al., 2020; Kukul & Karatas, 2019; Ching et al., 2018; Yen et al., 2012), which represents a new pattern for understanding human behavior (Bundy, 2007; Wing, 2008). Computational thinking is a skill that shapes future professions (Avcu & Ayverdi, 2020; Weese & Feldhausen, 2017; Yadav et al., 2017; Bers et al., 2014).

Computational thinking skills can be developed by enhancing computational self-efficacy, which positively affects students’ learning (Ross et al., 2001; Cassidy & Eachus, 2002; Thoonen et al., 2010) and represents a strong motivation for learning and practicing computational thinking skills (Malone & Lepper, 2021; Murnieks et al., 2020). Talsma et al. (2018) and Özmen and Altun (2014) indicate that one of the reasons for students’ difficulties in learning and practicing computational thinking skills is low self-efficacy; therefore, studies have focused mainly on variables such as self-efficacy and its relationship with computational performance (Yildiz-Durak & Saritepeci, 2018; Kong et al., 2018; Yang & Cheng, 2009; Cassidy & Eachus, 2002).

Korhonen (2018) and Huppert and So (2013) also noted that students’ subject-related self-efficacy is an indicator of academic well-being. Self-efficacy represents an individual’s positive evaluation of his life and is a positive indicator of life satisfaction, which has implications for academic well-being (Shek and Chai, 2020; Chen et al., 2017; Howell et al., 2013; Rey et al., 2011; Proctor et al., 2009; Huebner et al., 2004). Moreover, computational thinking involves complex patterns of thinking that require a degree of mental health in students (DeRosier et al., 2013) and a change in the learning culture from a culture of stress to a culture of well-being and flourishing (Gesun, 2021; Jensen, 2021), as academic well-being affects the learner’s thinking, attention, and information interpretation processes, which are essential requirements for computational thinking (Lambert et al., 2015).

Therefore, it is important to know the levels of computational thinking skills, computational self-efficacy, and academic well-being; to study the potential relationships among computational self-efficacy, computational thinking skills, and academic well-being; and to verify the role of computational thinking skills and computational self-efficacy in predicting academic well-being among university students.

**Conceptual Framework**

**Computational thinking skills**

Computational thinking (CT) is defined as the mental activity of deriving problems and formulating solutions (de Jesusi et al., 2022; Yadav et al., 2014) and represents a combination of other thinking styles, such as abstract thinking, modeling thinking, and procedural thinking (Román-González et al., 2017).

Computational thinking skills are defined in algorithmic thinking; abstraction; problem decomposition; data collection, representation, and analysis; parallelization; control flow; incremental and iterative; testing and debugging; and questioning (Weese & Feldhausen, 2017; Barr et al., 2011).

These skills enable students to acquire new strategies for solving problems and finding new solutions for the real and virtual worlds (Wing, 2008), enhance creative thinking, provide new ways to view social and physical phenomena (Miller et al., 2013; Settle et al., 2012), improve students’ attitudes toward practicing computational thinking (Sun et al., 2022; Gulbahar et al., 2019; Dickerson, 2019; Brennan & Resnick, 2012), enhance academic achievement (Lei et al., 2020), and understand many academic fields, such as mathematics, when mathematical algorithms are applied (Grover & Pea, 2013). Therefore, it becomes important to include computational thinking skills in the curriculum (Pewkam & Chamrat, 2022; Nordén et al., 2017) and for the student to possess a high level of these skills by planning activities that allow for the effective application of computational thinking skills (Huda & Rohaeti, 2024).

Studies have shown that students have a below-average level of computational thinking skills (Wardani et al., 2022; Rosali & Suryadi, 2021), and Korkmaz et al. (2015) reported that students have an average level of perceptions of computational thinking skills. Prabawa et al. (2024) reported that students have an average level of computational thinking ability, problem-solving and innovation skills are the most dominant skills, and algorithmic thinking skills are the least dominant skills. Katai et al. (2021) reported that computational thinking skills increase with students’ cognitive development and maturity. Chongo et al. (2020) reported that students have a high level of computational thinking skills and that there is a relationship between computational thinking skills and achievement. Although studies have reported mixed results concerning the association between computational thinking and academic achievement, some have indicated a significant positive association between them (Lei et al., 2020; Mindetbay et al., 2019; Lishinski et al., 2016; Yildiz-Durak & Saritepeci, 2018; Gülmez and Özdener, 2015; Haddad & Kalaani, 2015), indicating that there is no significant association between them (Doleck et al., 2017; Miller et al., 2013).

**Computational Self-Efficacy**

Bandura (1995; 1977) indicated that self-efficacy is related to an individual's beliefs and motivations and expresses an individual's confidence in his ability to achieve a specific goal or solve a problem, control his level of performance (Bandura, 1993), persistence when facing difficult tasks, and resilience in the face of difficulty or failure (Nordén et al., 2017; Schunk et al., 2014). Computational self-efficacy is defined as the effort made by an individual to practice computational thinking, solve programming-based computer problems, and achieve an attitude toward computational thinking skills (Yagci, 2016; Trevelyan, 2011; Compeau and Higgins, 1995). It expresses an individual's judgments about using digital tools creatively (Espinosa et al., 2021; Marakas et al., 1998).

Self-efficacy is associated with concepts such as academic success, motivation, competence building, self-regulation, self-knowledge, autonomy, and happiness (Espinosa et al., 2021; Yahyanezhad & Moharer, 2020; Zee et al., 2016; Thoonen et al., 2010; Zimmerman, 2000), is positively associated with a high level of educational technology use (Buchanan et al., 2013), is associated with computer literacy (Gudek, 2019), is one of the most influential factors in behavior (Anastasiadou & Karakos, 2011), represents the emotional aspect of computational thinking skills (Avcu & Ayverdi, 2020; Safari et al., 2020; Türker & Pala, 2020), works to develop computational thinking skills such as analysis, problem solving, and error correction (Yildiz-Durak et al., 2019; Shell et al., 2014), increases interest in the learning process and development of academic self-concept (Pellas & Kazanidis, 2014), increases individuals’ intention to use technology and digital tools (Afari et al., 2023; Gudek, 2019), and reduces computer anxiety (Gudek, 2019; Durndell & Haag, 2002), Self-efficacy is an important variable in predicting computational thinking (Dickerson, 2019; Tsai et al., 2018) and influences the practice of computational thinking skills (Malone & Lepper, 2021; Murnieks et al., 2020; Kong et al., 2018; Yildiz-Durak & Saritepeci, 2018; Nordén et al., 2017; Özmen and Altun, 2014; Thoonen et al., 2010; Yang & Cheng, 2009). Therefore, education in modern societies aims to increase students' self-efficacy to improve their computational thinking skills and use technology (Korucu et al., 2017).

A person with high computational self-efficacy has good perceptions of his ability to use a computer (Turel, 2014), uses digital tools efficiently (Dumbauld et al., 2014), tries to maintain motivation and develop computer skills (Schunk, 1991), develops effective strategies for dealing with complex problems (Odaci, 2013), and expands the scope of his personal goals, which generates better psychological health (Safari et al., 2020). A person with lower computational self-efficacy exerts less effort in performing a task and fails to complete the task (Nordén et al., 2017). Thus, studies indicate the importance of having a high level of computational self-efficacy as a strong predictor of continuing performance and learning computational thinking skills (Espinosa et al., 2021; Krejčová et al., 2019; Yildiz-Durak et al., 2019; Valencia-Vallejo et al., 2016; Shell et al., 2014; Thoonen et al., 2010; Ramalingam & Wiedenbeck, 1998).

 Studies have shown that students have low levels of self-efficacy in using computer skills and multimedia programs (Sarfo et al., 2016; 2017) and using technology in the classroom (Singh et al., 2018) and that this low level leads to difficulty in learning and practicing computational thinking skills (Schwarzhaupt et al., 2021; Espinosa et al., 2021; Talsma et al., 2018). Low perceptions of students about themselves in the field of computing (self-efficacy) and a perceived lack of self-confidence and ability to succeed were found to be inhibitors that hinder their entry into the fields of computational thinking (Ahadi et al., 2017; Stout and Tamer, 2016).

However, studies have shown mixed results. There is a strong relationship between self-efficacy and programming (Davidson et al., 2010), a relationship between self-efficacy and information and communication technology (Hatlevik et al., 2018), a relationship between the level of computational self-efficacy and general and specific computer knowledge and the attitude toward digital technology (Gudek, 2019), and a direct and significant relationship between computational self-efficacy and information skills (Espinosa et al., 2021), whereas there is a positive and medium-level relationship between self-efficacy and both computer programming and computational thinking skills (Avcu & Ayverdi, 2020; Wing, 2014; Roman-Gonzalez et al., 2018; Ciftci et al., 2018; Yildiz-Durak et al., 2019) and between computational thinking, reflective thinking and problem solving (Durak & Yilmaz, 2019; Bocconi et al., 2016; International Society for Technology in Education “ISTE”, 2016; Wing, 2014).

**Academic well-being**

The concept of well-being has been associated with positive psychology (Lambert et al., 2015; Biglan et al., 2012) and consists of a set of cognitive, emotional, and behavioral elements that enhance learner self-satisfaction (Akmal, et al., 2021; Renshaw and Bolognino, 2016). It expresses an individual’s happiness and satisfaction with life and awareness of his positive behaviors, such as positive feelings and thoughts (Yahyanezhad & Moharer, 2020; Renshaw, 2018), self-acceptance, personal growth, positive relationships with others, social acceptance, and freedom from physical and psychological diseases (Youssef –Morgan & Luthans, 2015), expresses the learner’s mental health (World Health Organization “WHO”, 2021), and achieves future results (Reynolds et al., 2024).

Academic well-being is the investment of the concept of well-being in the academic field, is related to academic achievement, academic stress, and academic satisfaction (Shek and Chai, 2020; Widlund et al., 2020; Govorova et al., 2020; Fiorilli et al., 2017), is related to school-related engagement and the creation of a positive, fulfilling study-related state of mind characterized by energy, dedication, and absorption (Salmela-Aro & Upadyaya, 2012), and is also associated with happiness (Yahyanezhad & Moharer, 2020; Diener et al., 1985; Andrews & Withey, 1976) because, according to the hedonic model, academic well-being and happiness depend primarily on experiencing pleasurable moments (Diener et al., 1985). Therefore, academic well-being plays a role in students’ academic achievement (Korhonen, 2018).

Researchers have conceptualized academic well-being as a multidimensional concept (Korhonen et al., 2016) consisting of cognitive and affective components of well-being (Chávez-Castillo, et al., 2023; Asghar et al., 2022) and shaped by a wide variety of variables, such as academic efficiency (an individual’s belief in their ability to perform or complete academic tasks), academic satisfaction (an individual’s assessment of the quality of their academic life), and college connection (an individual’s perceptions of pleasant and supportive relationships at school) (Renshaw, 2018; Renshaw & Bolognino, 2016).

Many studies have also examined the relationship between academic well-being and students’ academic achievement. It has become clear that the relationship between well-being and actual academic achievement is complex and that there is some contradiction in the results. Some studies show a positive relationship between cognitive academic well-being, mental health, and academic achievement (Klapp et al., 2024; Chávez-Castillo et al., 2023; Kansky et al., 2016; Luhmann et al., 2012; Ansari et al., 2011), some studies show low and weak positive relationships between academic achievement and subjective well-being in students (Amholt et al., 2020; Roeser et al., 1999; Watt, 2004; Eccles & Roeser, 2009; Lv et al., 2016; Cheng & Furnham, 2001; Huebner, 1991), while others fail to find such a relationship (Heller-Sahlgren, 2018; Reisberg, 2000).

There is also a relationship between cognitive well-being and self-efficacy (Robinson and Snipes, 2009), student satisfaction and life within the learning environment (Carter & Yeo, 2018), between academic self-efficacy and subjective well-being (Serinci et al., 2023), and between a learner with a high level of self-efficacy and high levels of subjective well-being (Santos et al., 2014; Mohtasham et al., 2024), as a learner with higher academic self-efficacy exerts more effort and perseverance to solve problems and overcome obstacles and challenges during learning and has a positive attitude and greater ability to adapt, which leads to increased academic well-being (Khodapanah & Tamannaeifar, 2023).

Datu and Mateo (2020) reported that there is an association between well-being (positive emotions and happiness) and self-efficacy. Callaghan et al. (2020), Khodapanah, & Tamannaeifar (2023), and Mohtasham et al. (2024) reported that there is a relationship among academic well-being, academic self-efficacy, and academic achievement among students. Serinci et al. (2023) reported that there is an effect of self-efficacy on psychological well-being among students, that there is a relationship between them, and that academic self-efficacy is a good predictor of psychological well-being. Khodapanah & Tamannaeifar (2023) reported that academic self-efficacy predicts academic well-being and that academic self-efficacy plays a stronger role in explaining the variance in academic well-being. Sahrai et al. (2017) suggested that academic well-being can be partially explained by academic self-efficacy. Therefore, McGeown et al. (2014) reported that academic self-efficacy is an important factor that predicts academic well-being.

Although studies have revealed a decline in students’ well-being (Ye et al., 2012) and a deterioration in students’ levels of well-being and mental health (Alkureishi et al., 2022; Chen et al., 2022) and that academic well-being ranks lower than does spiritual well-being, psychological, physical, subjective and social well-being among students (Ling et al., 2022), and students in higher education have low levels of well-being (Rynke et al., 2023) and that some students suffer from poor or very poor well-being (Szepe & Meszaros, 2024), academic well-being is among the most important indicators that affect the quality of their academic life (Durlak et al., 2011), plays a fundamental role in individual performance, enhances their thinking and problem-solving abilities (Faqih & Nasab, 2023), and contributes to good performance in school, academic satisfaction, stress reduction, and lower dropout rates (Shek & Chai, 2020; Korhonen et al., 2014), and develops a sense of life satisfaction and positive feelings toward the present and the future (Wu et al., 2020).

***On the basis of the above, the following questions can be addressed:***

***Q1. What are the students’ levels of computational thinking skills, computational self-efficacy, and academic well-being?***

***Q2. Is there a relationship between computational thinking skills, computational self-efficacy, and academic well-being?***

***Q3. Can academic well-being be predicted by computational thinking skills and computational self-efficacy among university students?***

**METHODS**

The study used the quantitative correlational predictive approach, as it focuses on determining the levels of computational self-efficacy, computational thinking skills, and academic well-being among students, determining the relationships among computational self-efficacy, computational thinking skills, and academic well-being. In addition, academic well-being may be predicted through computational thinking skills and computational self-efficacy among university students.

**The sample**

The targeted research sample consisted of 320 students at the Faculty of Specific Education, Mansoura University, whose ages ranged from 19--21 years, with an average age of 20.6 years and a standard deviation of 6.3 years. The age skewness coefficient was 0.432, meaning that there was moderation in the distribution of sample members on the research variables, and students who did not complete the response to the measurement were excluded; thus, the sample on which the analyses were conducted in its final form consisted of 280 male and female students, with 105 males at a rate of 37.5% and 175 females at a rate of 62.5%.

**Data collection tools**

***Computational Thinking Scale***

The scale aims to measure students' computational thinking skills. To construct the scale's items, previous literature and studies dealing with computational thinking were reviewed (Pewkam & Chamrat, 2022; de Jesusi et al., 2022; Román-González et al., 2017; Korkmaz et al., 2015; Bocconi et al., 2016; Grover & Pea, 2013; Wing, 2008). Accordingly, the tool consists of (20) items distributed into five dimensions of computational thinking: creative thinking, algorithmic thinking, collaborative thinking, critical thinking, and problem solving. The items were formulated on a five-point Likert scale (1 = "I completely disagree", 2 = "I disagree", 3 = "Neutral", 4 = "I agree", 5 = "I completely agree"). Thus, the maximum score of the scale becomes 100, and the minimum score becomes 20. The reliability of the computational thinking skills scale was verified via Cronbach’s alpha in a sample of 32 university students. Table 1 shows the stability coefficients for the scale dimensions.

***Table (1) Reliability Coefficients Related to the Computational Thinking Scale***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reliability Level** | **Sig.** | Cronbach’s Alpha Coefficient |

|  |
| --- |
| **Number of Items** |

 | **Dimension** |
| **high** | **0.01** | **0. 78** | 4  | **Creative Thinking** |
| **high** | 0.01 | **0.83** | 4 | **Algorithmic Thinking** |
| **high** | 0.01 | **0.87** | 4 | **Collaborative Thinking** |
| **high** | 0.01 | **0.76** | 4 | **Critical Thinking** |
| **high** | 0.01 | **0.81** | 4 | **Problem-Solving** |
| **high** | 0.01 | **0.84** | **20** | **Computational Thinking Skills Scale** |

The validity of the scale was also determined via the internal consistency method by calculating the correlation coefficient between the dimensions of the Computational Thinking Skills Scale, which ranged between 0.78 and 0.85 and was significant at the 0.01 level. The correlation coefficients between the dimensions of the Computational Thinking Skills Scale and the scale as a whole ranged between 0.81 and 0.89 and were significant at the 0.01 level. This indicates that the scale has high scores of validity, stability and internal consistency.

***Computational Self-Efficacy Scale***

The scale aims to measure students' computational self-efficacy. To construct the scale's items, the literature and previous studies that dealt with self-efficacy in general, computational self-efficacy, and digital self-efficacy were reviewed (Espinosa et al., 2021; Kukul and Karatas, 2019; Dickerson, 2019; Tsai et al., 2018; Nordén et al., 2017; Yang & Cheng, 2009; Cassidy & Eachus, 2002). Accordingly, the tool consists of 27 items distributed in nine dimensions of computational thinking: algorithms, abstraction, problem, decomposition, parallelization, data collection, control flow, incremental and iterative, testing and debugging, and questioning. The items were formulated on a five-point Likert scale (1 = "I completely disagree", 2 = "I disagree", 3 = "Neutral", 4 = "I agree", 5 = "I completely agree"). Thus, the maximum score of the scale becomes 135, and the minimum score becomes 27. The stability of the computational self-efficacy scale was verified via the alpha‒Cronbach method on a sample of 32 university students. Table 2 shows the stability coefficients for the scale dimensions.

 ***Table (2) Reliability Coefficients Relating to the Computational Self-Efficacy Scale***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reliability Level** | **Sig.** | Cronbach’s Alpha Coefficient |

|  |
| --- |
| **Number of Items** |

 | **Dimension** |
| **high** | **0.01** | **0.81** | **3** | **Algorithms** |
| **high** | 0.01 | **0.87** | **3** | **Abstraction** |
| **high** | 0.01 | **0.80** | **3** | **Problem Decomposition** |
| **high** | 0.01 | **0.86** | **3** | **Parallelization** |
| **high** | 0.01 | **0.85** | **3** | **Data Collection** |
| **high** | 0.01 | **0.88** | **3** | **Control Flow** |
| **high** | 0.01 | **0.81** | **3** | **Incremental and Iterative** |
| **high** | 0.01 | **0.82** | **3** | **Testing and Debugging** |
| **high** | 0.01 | **0.86** | **3** | **Questioning** |
| **high** | 0.01 | **0.85** | **27** | **Computational Thinking Self-Efficacy Scale** |

The validity of the scale was also calculated via the internal consistency method by calculating the correlation coefficient between the dimensions of the computational self-efficacy scale and the correlation coefficients between the dimensions of the computational self-efficacy scale and the scale as a whole, which ranged between 0.79 and 0.88 and was significant at the 0.01 level. This indicates that the scale has high scores of validity, stability and internal consistency.

***Academic Well-Being Scale***

The scale aims to measure students' academic well-being. To build the scale's vocabulary, the literature and previous studies that dealt with academic well-being were reviewed (Chávez-Castillo et al., 2023; Moliner et al., 2021; Renshaw, 2018; Nainian et al., 2017; Li et al., 2015; Renshaw & Arslan, 2016; Renshaw & Bolognino, 2016). Accordingly, the tool consists of 15 items distributed across three dimensions: academic satisfaction, academic efficacy and enjoying learning. The items were sent to 3 experts in the field of education and psychology, and in light of the experts' comments, the required modifications were made. The instrument, in its final form, consists of 15 items distributed across three dimensions: academic satisfaction, academic efficacy, and enjoying learning. The items were formulated on a five-point Likert scale (1 = "I completely disagree", 2 = "I disagree", 3 = "Neutral", 4 = "I agree", 5 = "I completely agree"). Thus, the maximum score of the scale becomes 75, and the minimum score is 15. The reliability of the academic well-being scale was verified via the alpha‒Cronbach method on a sample of 32 university students. Table 3 shows the reliability coefficients for the scale dimensions.

***Table 3 Reliability Coefficients Relating to the Academic Well-Being Scale***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reliability Level** | **Sig.** | Cronbach’s Alpha Coefficient |

|  |
| --- |
| **Number of Items** |

 | **Dimension** |
| **high** | **0.01** | **0. 79** | **5**  | **Academic satisfaction** |
| **high** | 0.01 | **0.86** | **6** | **Academic efficacy** |
| **high** | 0.01 | **0.82** | **7** | **Enjoy learning** |
| **high** | 0.01 | **0.83** | **18** | **Academic Well-Being Scale** |

The validity of the scale was also calculated via the internal consistency method by calculating the correlation coefficient between the dimensions of the academic well-being scale, which ranged between 0.76 and 0.84 and was significant at the 0.01 level. The correlation coefficients between the dimensions of the academic well-being scale and the scale as a whole ranged between 0.77 and 0.86 and were significant at the 0.01 level. This indicates that the scale has high scores of validity, stability and internal consistency.

**Data analysis**

To classify university students into high, medium, and low levels of computational thinking skills, computational self-efficacy, and academic well-being, respectively, and since the three scales follow a five-point scale in response to them, the scores used in each scale (the five-point scale) were divided into three levels of equal range by using the following equation: Category length = (highest value - lowest value) ÷ 3 = (5-1) ÷ 3 = 1.33. Table 4 shows this classification.

***Table 4 The actual limits of the response level scores (relative weights) on the scales according to the five-point Likert scale***

|  |  |  |
| --- | --- | --- |
| ***Arithmetic mean value*** | ***Percentage*** |  |
| **3.67- 5.00** | **100%– %73.4**  | ***High*** |
| **2.34 – 3.66** | **%73.2 – 46.8 %** | ***Medium*** |
| **1- 2.33** | **46.6% – %20** | ***Low*** |

The data were analyzed via descriptive statistics, specifically arithmetic means, relative means, standard deviations, percentages, and the hypothetical mean (highest theoretical score + lowest theoretical score/2) for each dimension of the scale and at the scale level as a whole. Pearson's correlation coefficient was used to calculate the relationships among the three variables (computational thinking skills, computational self-efficacy, and academic well-being). Regression coefficients were also used to study the effect of the independent variables on the dependent variable with the aim of predicting the scores of the dependent variable from the scores of the independent variables. In addition, inferential statistics, such as t tests, were used to determine the differences between the students' score means and the hypothetical means at the three scales. (Relative mean = arithmetic mean/number of scale items. The range of scores for the item (5 - 1 = 4) was divided into equal segments, so that the low level ranged from 1--2.32, the medium level ranged from 2.33--3.66, and the high level ranged from 3.67--5.

**Results and Discussion**

***Q1. What are the students’ levels of computational thinking skills, computational self-efficacy, and academic well-being?***

To answer this question, the relative mean was calculated, and a t test was used to compare the mean scores of the research sample and the hypothetical means of the three scales. Table 5 shows these results.

**Table 5. t test to compare the mean of the sample’s scores on the Computational Thinking Skills, Computational Self-Efficacy, and Academic Well-Being and the hypothesized mean.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | Hypothetical mean | Std. Deviation | t- test | Sign. | Relative mean | The Level |
| **Computational Thinking Skills** | 54.75 | 60 | 6.22 | 14.18 | 0.01 | 2.74 | Medium |
| **Computational Self-Efficacy** | 66.99 | 81 | 12.43 | 19.09 | 0.01 | 2.48 | Medium |
| **Academic Well-Being** | 37.00 | 45 | 11.81 | 11.34 | 0.01 | 2.47 | Medium |

As shown in Table 5, there are statistically significant differences between the students’ mean scores (54.75, 66.99, 37.00) and the hypothesized means (60, 81, 45) in computational thinking skills, computational self-efficacy, and academic well-being at a significance level of 0.01 in favor of the hypothesized mean. This means that the students’ level is average in computational thinking skills with a relative mean (2.74), in computational self-efficacy with a relative mean (2.48), and in academic well-being with a relative mean (2.47).

This result contrasts with studies that have shown that students have a below-average level of computational thinking skills (Wardani et al., 2022; Rosali & Suryadi, 2021). This finding is also consistent with a study by Chongo et al. (2020), who reported that students had a high level of computational thinking skills, and with a study by Katai et al. (2021), who reported that students’ possession of computational thinking skills increased with their cognitive development and maturity, while it was consistent with studies that reported that students had an average level of perceptions of computational thinking skills (Prabawa et al., 2024; Korkmaz et al., 2015).

This result contrasts with studies that reported low levels of self-efficacy in the use of computer skills, multimedia software, and database application software (Sarfo et al., 2016; 2017) and in the use of technology in the classroom (Singh et al., 2018).

This result is also in contrast to studies that reported low levels of academic well-being (Szepe and Meszaros, 2024; Rynke et al., 2023; Ye et al., 2012) and that there is a deterioration in well-being levels (Alkureishi et al., 2022; Chen et al., 2022) and that it ranks lower than students’ spiritual, psychological, physical, subjective, and social well-being (Ling et al., 2022).

On the basis of this result, it becomes necessary to pay attention to and develop computational thinking skills among students (Prabawa et al., 2024), include them in curricula (Pewkam & Chamrat, 2022; Nordén et al., 2017), and plan purposeful activities that allow for the effective application of these skills (Huda & Rohaeti, 2024; Katai et al., 2021).

This result highlights the importance of developing learners’ computational self-efficacy and having good perceptions of computational thinking skills (Turel, 2014), and developing effective strategies for dealing with complex problems (Odaci, 2013) because the availability of a high level of computational self-efficacy represents a strong indicator of continuing performance and learning computational thinking skills (Espinosa et al., 2021; Krejčová et al., 2019; Yildiz-Durak et al., 2019; Shell et al., 2014; Thoonen et al., 2010; Ramalingam & Wiedenbeck, 1998).

This result also indicates that the high level of academic well-being and its enhancement is a critical element in the learning process, as it is a good indicator of mental health and academic performance (Chávez-Castillo et al., 2023; Kansky et al., 2016; Luhmann et al., 2012), life satisfaction and positive feelings toward the present and the future (Wu et al., 2020; Carter and Yeo, 2018), affects the quality of academic life (Durlak et al., 2011), enhances thinking and problem-solving abilities (Faqih & Nasab, 2023), reduces stress and dropout rates among learners (Shek and Chai, 2020; Korhonen et al., 2014), and expands the scope of their personal goals to generate better mental health (Safari et al., 2020).

***Q******2: Is there a relationship between computational thinking self-efficacy, computational thinking skills, and academic well-being?***

Pearson’s correlation coefficient was used to explore this question, and the results are shown in Table 6.

**Table 6. Correlation coefficients between Computational Thinking Skills, Computational Self-Efficacy, and Academic Well-Being**

|  |  |  |
| --- | --- | --- |
| Variables | Computational Thinking Skills | Computational Self-Efficacy |
| Computational Self-Efficacy | 0.870\*\* | - |
| Academic Well-Being | 0.855\* | 0.959\*\* |
| \*\*The correlation coefficients are significant at 0.01. |

Table 6 shows a statistically significant positive correlation at the 0.01 level between academic well-being and computational thinking skills; the correlation coefficient was 0.855. Given that studies have shown a link between computational thinking and academic achievement (Lishinski et al., 2016, Doleck et al., 2017; Yildiz-Durak & Saritepeci, 2018; Gülmez and Özdener (2015 Haddad and Kalaani, 2015) and that cognitive well-being is positively related to academic achievement Klapp et al. (2024; Ansari et al., 2011) and mental health and academic performance (Chávez-Castillo et al., 2023; Kansky et al., 2016; Luhmann et al., 2012), a positive correlation between academic well-being and computational thinking skills is expected. Therefore, Faqih & Nasab (2023) indicated that academic well-being plays a fundamental role in an individual’s performance and enhances thinking. This result differs from studies that have indicated that there is no significant association between computational thinking and academic achievement (Doleck et al., 2017, Miller et al., 2013), that there is no correlation between academic well-being and students' academic achievement (Reisberg, 2000), and that the relationship between them is weak (Heller-Sahlgren, 2018) and not strong (Lv et al., 2016; Cheng & Furnham, 2001; Huebner, 1991), which indicates the expectation of no relationship between academic well-being and computational thinking skills.

This finding suggests that academic well-being is one of the most important indicators that affects the quality of one’s academic life, academic satisfaction, and stress reduction and enhances one’s ability to engage in "computational thinking" (Durlak et al., 2011; Shek and Chai, 2020 Korhonen et al., 2014; Faqih & Nasab, 2023) and opportunities to practice thinking (Asghar et al., 2022).

Table 6 also shows that there is a statistically significant positive correlation at the 0.01 level between academic well-being and computer self-efficacy. The correlation coefficient is 0.959, and this result is consistent with the findings of (Robinson and Snipes (2009), who confirmed the existence of a relationship between cognitive well-being and self-efficacy, and with studies that indicated a relationship between academic well-being and academic self-concept (Huebner & Gilman, 2006), which differs from studies that indicated a weak positive relationship between well-being and motivation among students (Amholt et al., 2020; Roeser et al., 1999; Watt, 2004; Eccles and Roeser, 2009). Despite this contradiction, these results support the relationship between academic well-being and other variables, such as life satisfaction and positive feelings toward the present and future (Wu et al., 2020), academic success, and positive psychological experiences and feelings in academic contexts (Reynolds et al., 2024), which in turn are associated with the learner’s self-efficacy.

These results are consistent with studies that have indicated positive relationships between self-efficacy and several variables, such as subjective well-being (Serinci et al., 2023; Santos et al., 2014), well-being (i.e., positive emotions and happiness) (Callaghan et al., 2020; Datu and Mateo 2020), academic well-being (Khodapanah & Tamannaeifar, 2023), and psychological well-being (Mohtasham et al., 2024). These results support that a learner with high levels of self-efficacy has high levels of subjective well-being (Santos et al., 2014) and exerts more effort and perseverance to solve problems and overcome obstacles and challenges that he faces during learning, which leads to increased academic well-being.

In addition, Table 6 shows a statistically significant positive correlation at the 0.01 level between computational thinking skills and computational self-efficacy; the correlation coefficient reached 0.870. These results are consistent with studies that have indicated a close relationship between computational self-efficacy and programming (Davidson et al., 2010), information and communication technology (Hatlevik et al., 2018), computer literacy (Gudek, 2020), and information skills (Espinosa et al., 2021), whereas they differ from studies that have indicated a positive and medium-level relationship between self-efficacy and both computer programming and computational thinking skills (Avcu & Ayverdi, 2020), computational thinking skills (Roman-Gonzalez et al., 2018; Ciftci et al., 2018; Yildiz-Durak et al., 2019), and computational thinking and problem solving (Yildiz-Durak et al., 2019; Bocconi et al., 2016; ISTE, 2016; Wing, 2014).

This finding supports studies that indicate that the practice of computational thinking skills is influenced by self-efficacy (Malone & Lepper, 2021; Murnieks et al., 2020; Yildiz-Durak & Saritepeci, 2018; Kong et al., 2018; Nordén et al., 2017; Özmen and Altun, 2014; Thoonen et al., 2010) and that a learner with high computational self-efficacy has good perceptions of his ability to use a computer (Turel, 2014), strong motivation to use computational thinking skills to solve problems (Richado et al., 2023), efficient use of digital tools (Dumbauld et al., 2014), and computer skills (Schunk, 1991), and develop effective strategies for dealing with complex problems (Odaci, 2013).

This result also supports the perspective that students’ perceptions of themselves in the field of computing (self-efficacy) and lack of self-confidence are inhibitory factors that hinder their entry into the field of computational thinking (Ahadi et al., 2017; Stout and Tamer, 2016) and that low self-efficacy leads to difficulty in learning and practicing computational thinking skills (Schwarzhaupt et al., 2021; Espinosa et al., 2021; Talsma et al., 2018). Therefore, a high level of self-efficacy in computational thinking becomes important as a strong predictor of learning computational thinking skills (Espinosa et al., 2021; Krejčová et al., 2019; Yildiz-Durak et al., 2019; Shell et al., 2014; Thoonen et al., 2010; Ramalingam & Wiedenbeck, 1998).

***Q3. Can academic well-being be predicted by computational thinking skills and computational self-efficacy among university students?***

Multiple regressions were used to explore the effects of the independent variables (computational thinking skills and computational self-efficacy) on the dependent variable (academic well-being), and the results are shown in Tables 7 and 8.

Table 7. Analysis of variance for academic well-being by digital resilience, digital stress and social support

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| variable | Source of difference | Sum of Squares | df | Mean Square | F | t | Sig. |
| Computational Thinking Skills | Regression | 28420.70 | 1 | 28420.70 | 755.039 | 27.478 | 0.001 |
| Residual | 10464.296 | 278 | 37.641 |  |
| Total | 38884.996 | 279 |  |  |
| Computational Self-Efficacy | Regression | 35770.343 | 1 | 35770.343 | 3192.7 | 56.504 | 0.001 |
| Residual | 3114.653 | 278 | 11.204 |  |
| Total | 38884.996 | 279 |  |  |

Table 7 shows a regression relationship between computational thinking skills as an independent variable and academic well-being as a dependent variable, with the value of “F” reaching 755.039, which is significant at the 0.001 level. Table 7 also shows a regression relationship between computational self-efficacy as an independent variable and academic well-being as a dependent variable, with the value of “F” reaching 3192.7, which is significant at the 0.001 level**.** Table 7 shows that the regression coefficients are significant at the (0.001) level. The T value (27.478, 56.504) is also significant at the (0.001) level.

Table 8 . Predicting academic well-being through Computational Thinking Skills and Computational Self-Efficacy

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | R | R Square | Adjusted R Square | B | Std.Error | Contribution % | Sig. |
| 1 | Constant | - | - | - | 52.099 | 3.263 | - | 0.001 |
| ComputationalThinkingSkills | 0.855 | 0.731 | 0.730 | 0.855 | 0.059 | 73.1% | 0.001 |
| 2 | Constant | - | - | - | 27.439 | 1.158 | - | 0.001 |
| ComputationalSelf-Efficacy | 0.959 | 0.920 | 0.920 | 0.962 | 0.017 | 92% | 0.001 |

Table 8 shows that the B values of the regression coefficients of computational thinking skills and computational self-efficacy are statistically significant at the 0.001 level. This result indicates that academic well-being can be predicted on the basis of the independent variables of computational thinking skills and computational self-efficacy.

The results also revealed that computational thinking skills and computational self-efficacy contribute 73.1% and 92%, respectively, to the prediction of academic well-being. Therefore, the predictive equation for academic well-being from the computational thinking skills score can be processed as follows: the predictive equation for academic well-being is 52.099 + 0.855 (computational thinking skills), and the predictive equation for academic well-being from the computational self-efficacy score can be processed as follows: the predictive equation for academic well-being is 27.439 + 0.962 (computational self-efficacy). These two equations indicate that the higher a student's scores on computational thinking skills and computational self-efficacy are, the higher his or her academic well-being scores are, and vice versa.

This result is consistent with the study of Serinci et al. (2023), who reported that academic self-efficacy significantly predicts subjective well-being; and the study of Khodapanah & Tamannaeifar (2023), who reported that academic self-efficacy predicts academic well-being and that it plays a strong role in explaining the variance of academic well-being. What confirms that computational self-efficacy can be a good predictor of academic well-being is the presence of a statistically significant correlation at 0.01 between computational self-efficacy and academic well-being (Table 6), and studies have indicated the presence of a positive relationship between self-efficacy and academic well-being and that the learner’s display of high levels of academic self-efficacy is accompanied by high levels of academic well-being (Mohtasham et al., 2024; Serinci et al., 2023; Khodapanah & Tamannaeifar, 2023).

**Suggestions**

In light of these results, the current study suggests the following:

* Different educational interventions can enhance students’ computational thinking skills, computational self-efficacy, and academic well-being.
* Designing and implementing educational programs and interventions that aim to enhance computational thinking skills and computational self-efficacy and maintain academic well-being for all students.
* Computational thinking skills and computer self-efficacy are incorporated as part of the curriculum offered in student preparation programs.
* Multiple regression models are developed by considering cognitive and noncognitive (affective) variables that predict academic well-being.

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