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Predicting Student Teachers' ESD Implementation Intention: The Role of Values, Beliefs, Attitudes, and Self-Efficacy

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Abstract

The study aims to understand the relationship between predictors of student teachers' intention to implement education for sustainable development (ESD). It proposes and evaluates the intention to implement the ESD model, which identifies the following predictors of student teachers' intention to implement ESD: (I) teacher self-efficacy, (II) teacher beliefs (about learning and teaching), (III) the assessment of the ESD value and (IV) attitudes towards sustainable development (SD). Using structural equation modeling, 706 student teachers' data have been analyzed. Teacher self-efficacy and ESD value assessment have a direct positive effect on the intention to implement ESD. Furthermore, the assessment of ESD values and constructivist teacher beliefs has an indirect positive effect on the intention to implement ESD mediated by teacher self-efficacy. The more student teachers assess themselves as capable of ESD implementation, nurturing constructivist beliefs about the nature of knowledge, learning, and teaching, as well as value education as a tool for advancing society toward SD, the higher their intention to implement ESD in the future.

Keywords: Education for sustainable development, intention to implement education for sustainable development, student teachers, teacher beliefs, teacher self-efficacy.

Introduction

In education for sustainable development (ESD), student teachers are considered crucial agents facilitating changes in – and promoting – sustainable development (SD; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2017). Their willingness to implement ESD is essential for the sustainable reconfiguration of institutions and educational processes. Student teachers face enormous challenges related to their role in attempting to achieve a sustainable future and the assessment of their personal qualifications to implement ESD (del Carmen Pegalajar-Palomino et al., 2021).

In policy documents (e.g., UNESCO, 2017, 2020), as well as in theoretical discussions (e.g., Rauch & Steiner, 2013; Sleurs, 2008), significant emphasis within ESD is placed precisely on students in teacher education programs, who are expected to become future teachers. They are perceived as a driving force of ESD and the realization of the Sustainable Development Goals (SDGs) towards a sustainable future. Student teachers are those who, in their imminent professional careers, will be in a position to implement ESD; however, the extent to which they will engage in its implementation ultimately depends on each individual. This decision largely depends on their personal assessments of whether they are prepared and willing to cope with this challenge.

This study focuses predominantly on student teachers and aims to examine the factors contributing to their intention to implement ESD. Since the study focuses on student teachers who, currently, do not have the opportunity to implement ESD, it primarily evaluates their level of intention to implement ESD as the closest measure of future behavior.

Intention to Implement Education for Sustainable Development

Numerous previous studies have identified teachers' intentions as the most important predictor of their consequent professional choices and actions (e.g., Billingsley et al., 2004; Singh & Billingsley, 1996; Rots et al., 2010; 2014). Teachers expressing an intention to act or behave in a certain manner are more likely to exhibit this behavior. Thus, it is not surprising that a large number of studies have focused on examining teachers' intentions, i.e., student teachers' intention to enter or stay in the teaching profession, (González et al., 2018; Rots et al., 2010; 2014) as well as their intention to implement certain curriculum domains (e.g., Cheng, 2015; Goldman & Coleman, 2013; Fahlman et al., 2011).

In the ESD context, teachers' intention to implement ESD can be assumed to represent a key predictor of their future behavior pertaining to ESD

implementation. However, there is a lack of research examining either the intentions of student teachers to implement ESD or the identification of factors shaping these intentions (Koskela & Kärkkäinen, 2021; Stössel et al., 2021). Therefore, this study proposes a hypothetical model of teachers' intentions to implement ESD. Moreover, existing theories and models explaining student teachers' intention to become teachers after graduation (e.g., Chapman, 1983; Rots et al., 2010), as well as their intention to implement other curriculum domains (Cheng, 2015; Goldman & Coleman, 2013; Fahlman et al., 2011), served as a basis for the development of the model presented in the current paper.

Predictors of Intention to Implement ESD

Theory of planned behavior (Ajzen, 1991) and the norm activation model (NAM, Schwartz, 1977; Schwarts & Howard, 1981) are most frequently applied to explain student teachers' intention to implement certain curriculum domains (e.g., health education). The aforementioned theories assume that the intention to behave or act in a particular manner is determined predominantly by an individual's evaluation of whether they can complete a certain activity or behave in a certain way (self-efficacy) and whether the specific action is valuable (value assessment).

As a concept derived from Bandura's social cognitive theory, self-efficacy is defined as a belief in one's own ability to successfully perform various tasks or behaviors (Bandura, 1997). Teacher self-efficacy refers to teachers' assessment of whether they can set certain educational goals, implement strategies, and achieve the set objectives (Tschannen-Moran & Woolfolk Hoy, 2001; Yoo, 2016). Several studies have confirmed the influence of teacher self-efficacy on teaching practice (e.g., Rubie-Davies et al., 2012; Ryan et al., 2015; Tschannen-Moran & McMaster, 2009). For example, Huitt (2003) highlighted that teacher self-efficacy represented the most important quality of teachers while predicting their behavior as well as students' classroom achievements.

According to the theory of planned behavior (Ajzen, 1991), NAM (Schwartz, 1977; Schwartz & Howard, 1981), as well as empirical research applying these frameworks to various forms of teacher behavior, teachers' assessments and attitudes toward certain behaviors or forms of professional action (e.g., specific types of education, teaching methods, or professional strategies) are significant predictors of their self-efficacy regarding those behaviors. Consequently, self-efficacy influences their behavioral intentions (e.g., Columna et al., 2016; Fahlman et al., 2011). ESD value assessment is considered a key competency that student teachers should develop to implement ESD successfully (Bertschy et al., 2013). In this study, the ESD value is defined as a value attribute that individuals assign to ESD and its implementation in the education system.

On the other hand, according to models explaining student teachers' intention to enter or stay in the teaching profession (e.g., Rots et al., 2010), teachers'

intentions are determined by their personal variables and their integration into the teaching profession. Additionally, integration into the teaching profession refers to the assessment of teachers' self-efficacy and teacher beliefs. Teacher beliefs, referring to the beliefs that teachers possess about the nature of teaching and learning (Pajares, 1992), are most commonly characterized based on the following two prototype ideologies: (I) teacher- or subject-centered teacher beliefs and (II) student-centered teacher beliefs (Kim & Buchanan, 2009). The former orientation emphasizes the transmission of knowledge and students' qualifications (direct transmission paradigm), whereas the latter orientation (constructivist paradigm) emphasizes the learning process and students' personal growth and development (Hermans et al., 2008; Meirink et al., 2009). Furthermore, previous studies (e.g., Rots et al., 2010; Braš Roth et al., 2014) have established a positive relationship between teacher beliefs and teacher self-efficacy. For example, Rots et al. (2010) stated that student teachers who predominantly adopt a constructivist perspective on student-centered learning and teaching exhibit higher levels of teacher self-efficacy and, consequently, higher intention to enter the teaching profession.

Apart from integration into the teaching profession, personal variables represent another important predictor of teachers' intentions. These variables are termed "personal" to differentiate between those referring to student teachers' professional functioning (such as those indicating integration into the teaching profession) and the ones referring to student teachers' daily private (personal) functioning, experiencing, and behavior. The idea that personal variables determine teachers' intentions is particularly interesting in the ESD context. Theoretical assumptions in the ESD field suggest that to ensure student teachers' readiness to integrate and facilitate ESD, they must not only develop skills and acquire knowledge but also possess affirmative attitudes, clear value orientation, and behaviors oriented toward sustainability (Albareda-Tiana et al., 2018; Cebrián & Junyent, 2015; Sleurs, 2008; Rauch & Steiner, 2013).

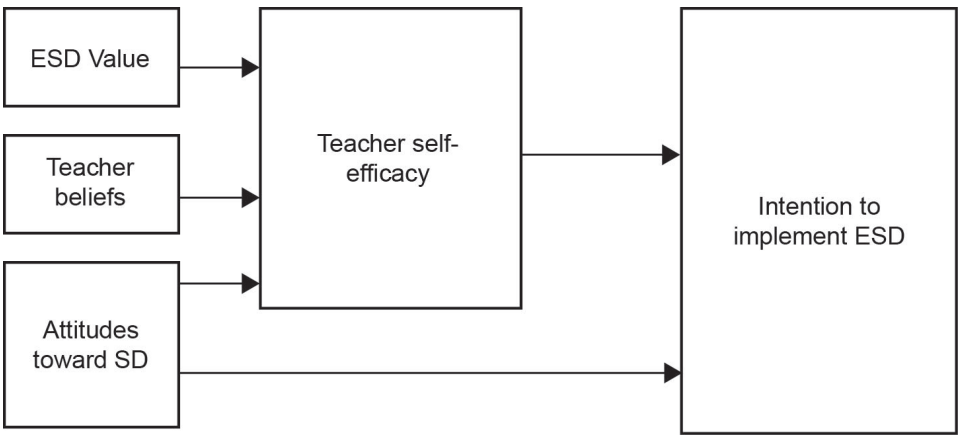
This study observed the relationship between attitudes toward SD as an indicator of student teachers' personal variables and (other) predictors of intention to implement ESD. Attitudes oriented toward support and the acceptance of the SD idea are expected to influence the future practice and subjective assessment of student teachers' willingness to act in the SD direction through ESD implementation (Vukelić, 2021).

Intention to Implement the ESD Model

By applying the aforementioned notions regarding the ESD context, a hypothetical model has been suggested (Figure 1), wherein potential predictors of student teachers' intention to implement ESD have been identified: (I) teacher self-efficacy, (II) teacher beliefs (regarding the nature of learning and teaching), (III) ESD value assessment, and (IV) attitudes toward SD.

Figure 1

Intention to Implement the ESD Model



The model assumes that student teachers who assess ESD highly, who possess student-centered teacher beliefs (constructivist paradigm), and who have positive attitudes towards SD will show higher levels of teacher self-efficacy for ESD. Higher levels of teacher self-efficacy will be related to a higher level of student teachers' intention to implement ESD. The described interrelations represent the assumed direct effects of the variables within the model.

Furthermore, the conceptual model assumes that teacher self-efficacy mediates the relationship between ESD value assessment, teacher beliefs, and intention to implement ESD. ESD value assessment and teacher beliefs are expected to not directly affect student teachers' intentions to implement ESD. However, their indirect effect on teacher self-efficacy is anticipated. The more student teachers nurture constructivist student-centered teaching beliefs and assess ESD value highly, the higher their teacher self-efficacy levels, and consequently, their intention to implement ESD. Moreover, attitudes toward SD are assumed to exhibit both direct and indirect effects (via teacher self-efficacy) on the intention to implement ESD.

The assumption about teacher self-efficacy as a mediator in the proposed model relies on previous notions derived from the testing of student teachers' intention to enter or stay in the teaching profession model (e.g., Rots et al., 2010; 2014), as well as previous research on student teachers' intention to implement certain curriculum domains (e.g., Sharma & Jacobs, 2016; Zint, 2002). The results of the previous studies indicated that teacher self-efficacy mediated the relationship between teachers' intentions and other tested variables (predominantly regarding the assessment of the importance of certain actions). Furthermore, empirical studies (e.g., Vukelić, 2021; Vukelić & Rončević, 2019) have determined that ESD value assessment represents a positive predictor of

teacher self-efficacy in the ESD context.

This study aims to empirically assess the proposed intention to implement the ESD model (Figure 1). Furthermore, it aims to:

(I) test the relationship between teacher self-efficacy of student teachers and their intention to implement ESD;
(II) evaluate teacher self-efficacy as the mediator of the relationship between ESD value and teacher beliefs, as well as student teachers' intention to implement ESD; and
(III) assess teacher self-efficacy as a partial mediator of the relationship between attitudes toward SD and student teachers' intention to implement ESD.

Materials and Methods

Participants

A total of 706 student teachers studying at all six Croatian universities that included different forms of teacher training programs (Zagreb, Split, Rijeka, Osijek, Zadar, and Pula) participated in the study. In total, 535 female students and 171 male students with an average age of 23.54 years (SD = 2.40) participated in the study.

Instruments

The Intention to implement ESD scale (Vukelić, 2021) has been used to measure student teachers' intention to implement ESD. The scale comprises 33 items divided into four subscales:

(I) intention to implement ESD content subscale (4 items);
(II) general intention to implement ESD subscale (10 items);
(III) intention to implement ESD teaching approaches and methods (7 items);
(IV) intention to focus on achieving ESD learning goals (12 items).

Items referring to the general intention to implement ESD as well as those referring to the intention to implement sustainable development content have been assessed on a 7-point Likert scale ranging from "1 = *I completely disagree*" to "7 = *I completely agree*." Items referring to the intention to implement ESD teaching approaches and methods and those referring to the intention to focus on achieving ESD learning goals have been assessed on a 7-point Likert scale measuring usage frequency from "1 = *never*" to "7 = *always*." The scale has a four-factor structure; its internal consistency ranges from $\alpha = 0.86–0.97$ between subscales (Vukelić, 2021).

Teacher self-efficacy for ESD scale (constructed based on items used in Effeney & Davis, 2013; translated and adapted into Croatian in Vukelić, 2021; Vukelić & Rončević, 2019) has been applied to measure teacher self-efficacy for ESD. The instrument comprises seven statements, and the participants' task is to rate the degree of agreement with the listed statements on a 5-point Likert scale, wherein "1 = *I completely disagree*" and "5 = *I completely agree.*" The instrument demonstrates a one-factor structure; its internal consistency, as determined in previous studies (Vukelić, 2021; Vukelić & Rončević, 2019), is α = 0.66–0.88.

The teacher beliefs scale (Organisation for Economic Co-operation and Development [OECD], 2019; Braš Roth et al., 2014; Vukelić, 2021) has been used to measure teacher beliefs. It comprises eight items that measure (I) constructivist teacher beliefs (four items) and (II) direct-transmission teacher beliefs (four items). The participants' task is to rate their degree of agreement with the given statements on a 5-point Likert scale, wherein "1 = *completely disagree*" and "5 = *completely agree*." The instrument has a two-factor structure. Previous studies (Vukelić, 2021) have indicated a satisfactory level of internal consistency: Cronbach's alpha for constructivist teacher beliefs subscale is α = 0.837, while that for direct-transmission teacher beliefs is α = 0.733.

The ESD value scale (constructed based on items used in Effeney & Davis, 2013; translated and adapted into Croatian in Vukelić, 2021; Vukelić & Rončević, 2019) has been used to assess student teachers' perceptions of ESD value. The instrument comprises four statements. The participants' task is to express their degree of agreement with the listed statements on a 5-point Likert scale, wherein "1 = *I disagree completely*" and "5 = *I agree completely*." In previous studies (Vukelić, 2021; Vukelić & Rončević, 2019), a one-factor questionnaire structure has been obtained with the scale internal consistency ranging from α = 0.75–0.91.

Attitudes toward sustainability subscale from the Sustainability Consciousness Questionnaire (SCQ; Gericke et al., 2018), translated and adapted into Croatian (Vukelić, 2021), has been used to measure attitudes toward ESD. Furthermore, the subscales measure attitudes toward (I) environmental (four items), (II) social (six items), and (III) economic sustainability (four items). Participants' task is to express the degree of agreement with each of the listed items on a 5-point Likert-type response format, wherein "1 = *completely disagree*" and "5 = *completely agree*." The subscale has a three-factor subscale; its Cronbach's alpha coefficient of internal consistency for attitudes toward environmental sustainability factor is α = 0.638, for attitudes toward social sustainability factor is α = 0.867, and for attitudes toward economic sustainability is α = 0.828 (Vukelić, 2021).

Procedure

Prior to starting the study, ethical approval has been obtained from the Faculty of Humanities and Social Sciences in Rijeka. Furthermore, the study has been conducted according to the guidelines of Ethics Committee at the University

of Rijeka, and ethical principles of conducting the research at the Faculty of Humanities and Social Sciences. Informed consent has been obtained from all participants involved in the study.

The research has been conducted using a combination of printed and online questionnaires completed during regular teacher education lessons in Croatia. On average, the participants need 20–30 minutes to complete the questionnaire.

Results

The data have been analyzed using Mplus 8.7 and IBM SPSS Statistics version 23.0. The relationships between the variables in the intention to implement the ESD model have been calculated using structural equation modeling and maximum likelihood estimation with the robust standard errors method (MLR). To estimate the goodness of model fit, the following indices have been used: chi-square test, the ratio of chi-square to degrees of freedom, root mean square error of approximation (RMSEA), standardized root mean square residuals (SRMR), comparative fit index (CFI), and Tucker and Lewis index (TLI). The desirable value of the ratio between the value of the Chi-square and degrees of freedom should be below 2 (Byrne, 2016), with some authors arguing that the acceptable ratio is below 5 (Hooper et al., 2008). CFI and TLI values equal to or greater than 0.9 indicate satisfactory model fit, whereas values greater than 0.95 indicate excellent model fit (Byrne, 2016; Hooper et al., 2008). In this study, RMSEA and SRMR indicator values equal to or less than 0.8 are considered indicators of good model fit (Hu & Bentler, 1999).

Due to the complexity of the intention to implement the ESD model, which comprises a large number of latent and manifest variables, the parceling technique has been applied (Matsunaga, 2008). Parceling has been conducted by aggregating each questionnaire item with either one or two of its following items. Therefore, (I) three parcels for teacher self-efficacy for ESD (TSE1, TSE2, TSE3), (II) two parcels for ESD value assessment (V1 and V2), (III) two parcels for constructivist teacher beliefs (CTB1 and CTB2), and (IV) two parcels for direct transmission teacher beliefs (DTB1 and DTB2) have been created. Moreover, four parcels have been created for the intention to implement ESD measures on the basis of linear composites of four intentions to implement ESD subscales: (I) intention to implement ESD content (IC), (II) general intention to implement ESD (GI), (III) intention to implement ESD teaching approaches and methods (ITAM), and (IV) intention to focus on achieving ESD learning goals (ILG). Additionally, three parcels have been created for attitudes toward the SD variable based on linear composites of the three attitudes toward sustainability subscale factors found in the Sustainability Consciousness Questionnaire: (I) environmental (A_ENV), (II) social (A_SOC), and (III) economic sustainability (A_ECO).

The Kolmogorov-Smirnov test has been used to assess the normality of distribution. It has been determined that parcel distributions significantly deviate

from a normal distribution (K-S values range from 0.06–0.20; obtained on a large sample, these findings are statistically significant at the level of $p < 0.01$).

Prior to testing the model that assumed indirect effects on the intention to implement ESD via teacher self-efficacy, the conditions of mediation have been verified according to Baron and Kenny (1986). The results of the correlation analyses (Appendix, Table 3) imply that direct transmission teacher beliefs are not significantly correlated with any intention to implement the ESD subscale. In other words, a significant effect that can be mediated by teacher self-efficacy in ESD does not exist. Therefore, the direct transmission teacher belief variable has been excluded from further analyses.

The intention to implement the ESD model fit has been tested by comparing the nested models. The Satorra–Bentler scaled chi-square test has been used as a criterion to determine the significance of the difference in the model fit of the two nested models (Satorra & Bentler, 2001). The procedure for comparing nested models as described by Anderson and Gerbing (1988) has been used.

Table 1

Goodness of Fit Indices

Model (N = 706)	**χ^2(df)**	**χ^2/df**	**SRMR**	**RMSEA**	**CFI**	**TLI**	**SCF**
CFA	250.141(67)	3.73	.033	.060	.968	.956	
Model 1	250.141(67)	3.73	.033	.062	.968	.956	1.1567
Model 2	373.814(70)	5.34	.074	.078	.947	.931	1.1634
Model 3	322.701(69)	4.68	.046	.072	.956	.941	1.1519
Model 4	249.553(68)	3.67	.033	.061	.968	.957	1.1604

Note: χ^2 – Chi-square; df – degrees of freedom; SRMR – standardized root mean square residuals; RMSEA – root mean square error of approximation; CFI – comparative fit index; TLI – Tucker and Lewis index; SCF – scaling correction factor

A partially mediated model is one in which all direct and indirect effects of the predictors on the dependent variables (mediator and outcome) have been tested in the first stage (Model 1). The model configured in this manner exhibits an excellent model fit (Table 1).

A fully mediated model, in which all direct effects of predictors on the dependent variable (outcome) are excluded, has been tested during the next stage (Model 2). The Satorra–Bentler scaled chi-square test suggests a statistically

significant difference in model fit ($\Delta\chi^2$ [df = 3] = 110.86; $p < 0.001$; CD = 1.31) between partially and fully mediated models, whereas the fully mediated model fit is statistically significantly worse than the partially mediated model fit.

During the following stage, one direct effect assumed by the conceptual intention to implement the ESD model (the effect of attitudes toward SD on intention to implement ESD) has been included in the analysis. Model configuration (Model 3) shows a satisfactory model fit (Table 1). Again, the result of the Satorra–Bentler scaled chi-square test implies a statistically significant difference in model fit ($\Delta\chi 2$ [df = 2] = 83.12; $p < 0.001$; CD = 0.9911) between Model 3 and the partially mediated model, whereas the fit of this model with empirical data is statistically significantly worse than the partially mediated model fit.

Since a model exclusively comprising theoretically defined direct effects shows a statistically significant decrease in model fit compared to the partially mediated model, modification indices have been examined to identify the additional relationships between model variables, whose introduction will result in model fit improvement. According to the modification indices, the introduction of an ESD value assessment direct effect on the intention to implement ESD results in the largest model fit increase (MI = 61.196). This model configuration (Model 4) shows excellent model fit. The Satorra–Bentler scaled chi-square test implies that a statistically significant difference in this model fit compared to the partially mediated model ($\Delta\chi 2$ [df = 1] =0.18; $p > 0.05$; CD = 1.41) is not present, whereas the fit of this model with empirical data is not statistically significantly worse than the partially mediated model fit. Therefore, Model 4 has been retained as the final intention to implement the ESD model (Figure 2).

This model configuration (Model 4) explains 69.8 % of the intention to implement ESD variance and 28.6 % of teacher self-efficacy for ESD variance.

Table 2 shows the direct, indirect, and total effects of teacher self-efficacy, assessment of ESD value, constructivist teacher beliefs and attitudes toward SD on intention to implement ESD, and their significance determined by bootstrapped confidence intervals. This study has used 1000 bootstrap sampling with confidence intervals of 95 % (CI).

Table 2

Significance of the Direct, Indirect, and Total Effects Determined by the Bootstrapped Confidence Intervals

Direct effects on teacher self-efficacy	**ß**	**Lower 95 % CI**	**Upper 95 % CI**
ESD value	0.383	0.284	0.490
Constructivist teacher beliefs	0.237	0.126	0.331
Attitudes toward SD	-0.034	-0.114	0.071
Direct effect on the intention to implement ESD	**ß**	**Lower 95 % CI**	**Upper 95 % CI**
Teacher self-efficacy	0.543	0.491	0.599
ESD value	0.384	0.310	0.452
Attitudes toward SD	0.052	-0.014	0.115
Indirect effects on intention to implement ESD (via teacher self-efficacy)	**ß**	**Lower 95 % CI**	**Upper 95 % CI**
ESD value	0.208	0.155	0.267
Constructivist teacher beliefs	0.128	0.068	0.179
Attitudes toward SD	-0.019	-0.077	0.039
Total effects on intention to implement ESD	**ß**	**Lower 95 % CI**	**Upper 95 % CI**
Teacher self-efficacy	0.543	0.491	0.599
ESD value	0.592	0.515	0.668
Constructivist teacher beliefs	0.128	0.068	0.179
Attitudes toward SD	0.034	-0.053	0.116

Note: Standardized regression coefficients (ß) are shown. CI = confidence interval

Teacher self-efficacy has a direct positive effect on intention to implement ESD, indicating that a higher assessment of teacher self-efficacy is related to higher levels of intention to implement ESD.

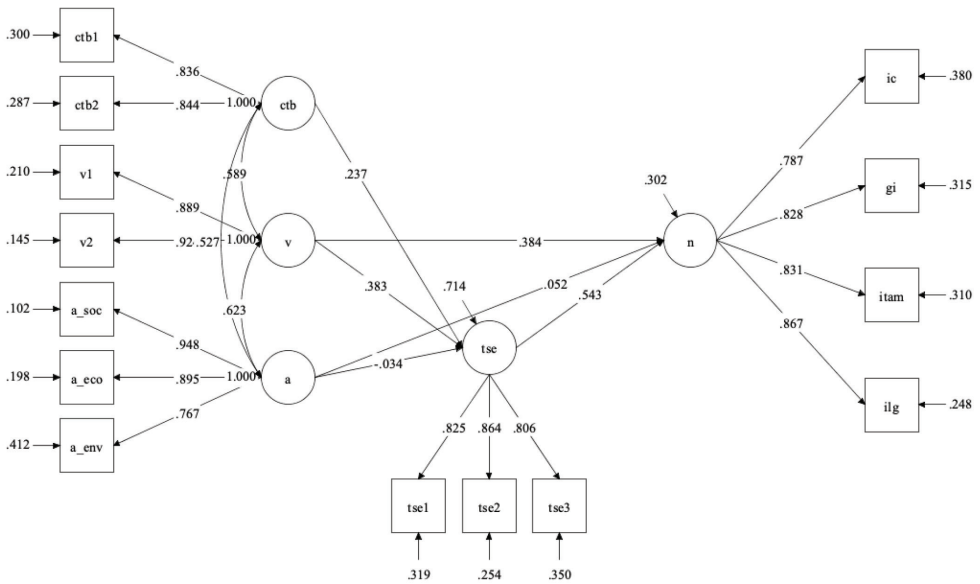
A significant indirect effect of ESD value assessment on intention to implement ESD mediated by teacher self-efficacy for ESD has been found. In other words, the assessment of ESD value increases teacher self-efficacy, enabling ESD value to indirectly positively affect the intention to implement ESD, indirectly leading to a higher level of intent to implement ESD. In addition to the stated indirect effect, ESD value assessment has a direct positive effect on the intention to implement ESD, which has not been specified in the hypothetical model (Table 2).

Constructivist teacher beliefs have a significant and positive indirect effect on the intention to implement ESD via teacher self-efficacy. Constructivist teacher beliefs increase teacher self-efficacy, thereby indirectly increasing the intention to implement ESD.

Contrary to the assumptions of the hypothetical model, attitudes toward SD do not exhibit a significant direct, indirect, or total effect on the intention to implement ESD.

Figure 2

The Final Version of the Intention to Implement the ESD Model



Note: Standardized regression coefficients are shown. n – intention to implement ESD; ic – intention to implement ESD content; gi – general intention to implement ESD; itam – intention to implement ESD teaching approaches and methods; ilg – intention to focus on achieving ESD learning goals; tse – teacher self-efficacy for ESD (tse1, tse2, tse3); v – ESD value assessment (v1, v2); ctb – constructivist teacher beliefs (ctb1, ctb2); a – attitudes toward the SD; a_env – attitudes toward environmental sustainability; a_soc– attitudes toward social sustainability; a_eco – attitudes toward economic sustainability

Discussion

In the attempt to evaluate the intention to implement the ESD (theoretical) model, it has been determined that higher estimates of teacher self-efficacy are related to higher levels of intention to implement ESD. Additionally, higher

assessments of ESD value and higher levels of constructivist teacher beliefs are related to higher teacher self-efficacy levels. Therefore, students who value ESD highly, as well as those who foster constructivist teacher beliefs, assess themselves as more capable of implementing ESD. Self-efficacy beliefs increase when teachers perceive a strong fit between their pedagogical beliefs and the demands of a specific teaching task (e.g., Guangbao & Timothy, 2021; Thommen, 2022), in this case, the implementation of ESD. Given that the constructivist pedagogy closely aligns with the core principles of ESD, emphasizing student-centered approaches, critical thinking, problem-solving, interdisciplinarity, and real-world application (e.g., UNESCO, 2017, 2020), this may contribute to higher levels of teacher self-efficacy in the context of ESD among student teachers who hold constructivist beliefs. Moreover, student teachers with constructivist views are more likely to see their role as facilitators of learning rather than transmitters of knowledge (Kim & Buchanan, 2009; Meirink et al., 2009), which is essential in fostering students' agency and participation, both of which are central to ESD. Furthermore, ESD value assessment and teacher beliefs are expected to have an indirect effect on the intention to implement ESD, mediated by teacher self-efficacy. This is confirmed for the *teacher beliefs* variable, whereas confirmation is only partial for the *ESD value* variable. Constructivist teacher beliefs and ESD value assessment have an indirect effect on the intention to implement ESD mediated by teacher self-efficacy. In other words, higher levels of ESD value assessment and constructivist teacher beliefs precipitate higher levels of teacher self-efficacy, indirectly resulting in higher levels of intention to implement ESD. The obtained results fit the previously mentioned theoretical assumptions and are in line with findings of the previous studies (e.g., Ajzen, 1991; Schwartz, 1977; Chapman, 1983; Cheng, 2015; Rots et al., 2010).

However, deviating from expected outcomes, the ESD value assessment directly affects the intention to implement ESD. A direct relationship between the ESD value assessment and intention to implement ESD has not been assumed in the original hypothetical model. Instead, it has been introduced into the model during the final stage of model testing based on the modification indices. Arguments in favor of introducing this direct effect into the tested model are based on theoretical and empirical explanations. The results of several previous empirical studies have indicated the existence of a significant bivariant connection between the assessment of certain curriculum areas and teacher intention. For example, Ko and Lee (2003) found a positive relationship between teachers' perceptions of environmental education and their willingness to implement the same form of education in their professional work. Additionally, Sharma and Jacobs (2016) found that both attitudes and assessments of inclusive education represented significant predictors of teachers' intention to teach in inclusive classes, ultimately increasing the readiness of teachers who valued inclusive education to teach in inclusive classes. Apart from the results of the previous studies highlighting the existence of significant bivariate relationships between the perceived value of a

certain form of education and teachers' intention to implement it, arguments in favor of the implementation of the direct effect between ESD value assessment and intention to implement ESD can be found in expectancy-value theory (Eccles, 2005; Eccles & Wigfield, 2002). According to this theory, an individual's behavior is predominately influenced by motivational beliefs, such as success expectancy and task value. Additionally, subjective task value refers to an individual's beliefs related to the reasons and motives they get involved in a certain activity, i.e., the reason that they should participate in that activity (Wigfield & Eccles, 2000). Specifically, the higher the individual's value of completing a certain task or behavior, the higher the probability that they will behave accordingly. The results of the current study are also in line with the ideas proposed in expectancy-value theory (Eccles, 2005; Eccles & Wigfield, 2002). Assessing ESD directly assumes the intention of student teachers to implement it. It is possible that student teachers' perceptions of ESD values become a motivational factor that directly leads to higher levels of intention to implement ESD.

Finally, attitudes toward SD are expected to (I) positively contribute to the teacher self-efficacy of student teachers, (II) positively contribute to student teachers' intention to implement ESD (direct effect), and (III) indirectly affect the intention to implement ESD via teacher self-efficacy. However, these assumptions have not been confirmed. Attitudes toward SD do not exhibit a direct effect on the intention to implement ESD or an indirect effect mediated by teacher self-efficacy. In the search for an explanation regarding the lack of connection between attitudes and other variables in the model, the answer may be found in the sustainability science field. The same field often emphasizes the role of attitudes when attempting to explain various sustainable behaviors (e.g., Evans et al., 2007; Heimlich & Ardoin, 2008). Although most authors have agreed that attitudes certainly represent an important factor in pro-ecological and pro-sustainable behavior, numerous conclusions found in previous empirical research are both ambiguous and contradictory, for example, studies highlighting a lack of connection between attitudes and behavior or behavioral intention (e.g., Chen, 2010; Chen et al., 2010; Cleveland et al., 2012; Nouri et al., 2008; Salas-Zapata et al., 2018). The results of these studies indicate that even individuals who are highly aware of sustainability issues and possess extremely positive attitudes toward the environment, as well as SD, do not necessarily exhibit the intention to behave pro-ecologically. In other words, while most individuals will possess positive attitudes toward the environment or SD, they will not necessarily behave or show an intention to behave either pro-ecologically or pro-sustainably. Other factors seemingly form an individual's intention to engage in sustainable behavior. Kollmuss and Agyeman (2002) suggested that variables such as locus of control and ascription of personal responsibility significantly contributed to the prediction of pro-ecological or pro-sustainable behavior or behavioral intention. Thus, individuals ascribing responsibility to themselves take accountability to tackle SD issues and problems. Additionally, those who believe that they can

have an impact during the same problem-solving process either already behave or express a higher level of intention to behave pro-ecologically.

Based on the above, the intention to implement the ESD model can be assumed to improve by introducing the ascription of the personal responsibility construct as a potential predictor of not only teacher self-efficacy but also intention to implement ESD. The personal responsibility construct, derived from NAM (Schwartz, 1977; Schwartz & Howard, 1981), states that individuals behave in accordance with their personal norms. Additionally, individuals must take responsibility for their actions (responsibility attribution) and assess whether they are capable of performing a particular behavior (self-efficacy assessment) to activate personal norms. Previous educational research has demonstrated a positive relationship between teacher self-efficacy and the ascription of personal responsibility (Lauermann & Karabenick, 2011; Kozel, 2007). Additionally, the ascription of personal responsibility for coping with SD challenges and issues represents a positive predictor of teacher self-efficacy in ESD (Vukelić & Rončević, 2019). Based on the NAM assumptions (Schwartz, 1977; Schwartz & Howard, 1981) as well as the results of several previous studies, it can be assumed that student teachers who, to a larger extent, attribute responsibility to themselves to cope with sustainability issues and challenges, can feel more prepared to implement ESD, i.e., they exhibit higher levels of teacher self-efficacy as well as intention to implement ESD. Student teachers who believe that it is their responsibility to tackle current sustainability issues recognize ESD as a framework within which they can initiate actions that would help resolve the abovementioned challenges and issues. Therefore, they pay greater attention to preparing for ESD implementation in their future professional career, consequently feeling better equipped to take this step and expressing higher levels of intention to implement it. Seemingly, evaluations of personal responsibility to cope with SD issues and challenges could more significantly impact teachers' intention to implement ESD than attitudes toward SD. However, these assumptions should be explored in future studies.

The intention to implement the ESD model is based on findings from theories that define individual factors that shape certain human behaviors and whose assumptions have been confirmed in many previous studies in different contexts. For this reason, the interrelationship and contribution of individual factors in explaining the intention to implement ESD identified in this study can be expected to be valid for other global settings, even though it has been conducted in a national context only. However, the decision of student teachers to implement ESD in their future professional work may be influenced by many other factors that are not considered in this model and may vary in different global contexts. One key factor is undoubtedly the aspects related to initial teacher education, such as different study programs that place a greater or lesser emphasis on SD, modern teaching methods and many other aspects that could potentially influence the decision of student teachers to implement ESD in their future professional life.

Pegalajar-Palomino et al. (2021) concluded in a systematic review that there was a deficit in teacher education in the development of skills necessary for the implementation of ESD. However, other research in this area suggests that the inclusion of ESD in teacher education programs contributes to a more positive attitude towards ESD, a higher assessment of knowledge about the topic and a higher level of sustainability-promoting behavior (e.g., Andersson et al., 2013; Brandt et al., 2019; Corrochano Fernández et al., 2023; García González et al., 2020; Saiful & Setyorini, 2022). An important step in further research would therefore be to attempt to model the contribution of teacher (initial) education to the explanation of student teachers' intention to implement ESD. At the same time, initial teacher education varies greatly from country to country and even within a country from study program to study program. The particular challenge is to develop a model that identifies the teacher education factors that contribute to student teachers' decision to implement ESD in their future professional life in different contexts.

Future research should at least test the intention to implement the ESD model across diverse higher education systems and cultural contexts. This would allow for cross-cultural comparisons and further validation of the model, contributing to the generalizability of the findings.

Besides, longitudinal studies that follow pre-service teachers into their professional careers could provide valuable insight into how initial motivation and self-perceived readiness evolve over time and under real classroom conditions. Additionally, such research should consider the broader institutional context, examining how organizational factors, such as school leadership, curricular frameworks, and institutional support, either facilitate or hinder the implementation of ESD in practice.

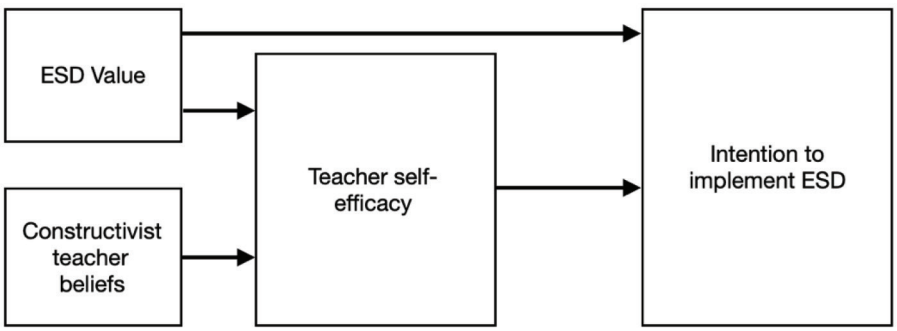
The findings of this study offer implications for teacher education. In light of the finding that teacher self-efficacy plays a pivotal role in predicting the intention to implement ESD, teacher education for ESD should emphasize the development of teacher self-efficacy by providing opportunities for experiential learning, critical reflection, and active engagement with real-world sustainability challenges. Furthermore, this research has shown that student teachers who value ESD highly and perceive themselves as competent to implement it are more likely to form a strong intention to integrate it into their future professional practice. Therefore, teacher education programs should support the development of personal values aligned with sustainability, encouraging student teachers to critically assess the transformative potential of ESD. Moreover, to effectively foster intention, teacher education programs should model participatory, interdisciplinary, and reflective teaching approaches, as they align with the pedagogical principles of ESD itself. In this way, the development of intention to implement ESD is not merely a matter of acquiring knowledge, but of forming professional identities committed to sustainability-oriented teaching.

Conclusion

This study has aimed to contribute to the understanding of predictors of student teachers' intention to implement ESD. The final version of the intention to implement the ESD model (Figure 3) has been defined based on the research findings. Predictors of the intention to implement ESD are as follows: (I) teacher self-efficacy for ESD, (II) constructivist teacher beliefs, and (III) ESD value assessment. Teacher self-efficacy for ESD and ESD value assessment have a direct positive effect on the intention to implement ESD. ESD value assessment and constructivist teacher beliefs have an indirect effect on the intention to implement ESD via teacher self-efficacy for ESD. Students who assess both their readiness to implement ESD (higher levels of teacher self-efficacy) and value of ESD highly tend to perceive themselves as more likely to take the next step in the future. Moreover, student teachers assessing ESD as high as well as those possessing more constructivist teacher beliefs feel better at implementing ESD (exhibiting higher levels of teacher self-efficacy), consequently expressing higher levels of intention to implement it.

Figure 3

The Final Conceptual Version of the Intention to Implement the ESD Model



The research results indicate the importance of assessing education as a means of social transformation toward SD – in addition to one's assessment of personal ability to implement ESD as well as constructivist beliefs about the nature of teaching and learning. Positive outcomes during the ESD implementation process can only be expected after the listed preconditions have been met. In this scenario, student teachers express a higher level of intention to implement ESD in their future professional work.

The research results can inform the decisions made during the development and improvement of study programs that focus on the factors that will motivate student teachers to implement ESD in their future professional work. Based on the research results, it is evident that programs designed to prepare student

teachers for ESD should focus on fostering their sense of readiness to implement ESD, encouraging their self-assessment of competence for such implementation, and strengthening their perception of ESD as a valuable direction for educational transformation.

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Appendix

Table 3

The Correlation Matrix Between All Composite Variables, Descriptive Data and Cronbach Alpha Coefficients

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	M	SD	α
1. General intention to implement ESD	1	.71**	.62**	.63**	.57**	.56**	.26**	-.06	.34**	.39**	.32**	50.39	11.31	.91
2. Intention to implement ESD content		1	.55**	.64**	.55**	.53**	.26**	-.06	.39**	.41**	.36**	21.63	4.82	.86
3. Intention to implement ESD teaching approaches and methods			1	.76**	.57**	.48**	.29**	.00	.26**	.31**	.27**	34.43	8.42	.93
4. Intention to focus on achieving ESD learning goals				1	.55**	.57**	.31**	.07	.39**	.47**	.43**	64.15	13.09	.97
5. Teacher self-efficacy for ESD					1	.43**	.23**	-.12**	.24**	.26**	.22**	22.36	5.08	.88
6. ESD value assessment						1	.46**	.09*	.50**	.61**	.53**	15.47	3.08	.91
7. Constructivist teacher beliefs							1	-.03	.40**	.48**	.39**	15.81	3.05	.84
8. Direct transmission teacher beliefs								1	-.01	.13**	.16**	14.94	2.77	.73
9. Attitudes towards environmental sustainability									1	.69**	.68**	11.53	2.13	.64
10. Attitudes towards social sustainability										1	.83**	24.59	4.13	.87
11. Attitudes towards economic sustainability											1	16.68	2.85	.83

Note: **p<0.01; *p<0.05; M – mean; SD – standard deviation; α – Cronbach alpha coefficient