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Student Teachers' Willingness to Act in the Climate Change Context

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Abstract: In education for sustainable development, widely regarded as a framework that offers us the opportunity to improve the ways in which we cope with climate change issues, the need for student teachers to express willingness to act in order to deal with numerous issues and challenges of sustainable development, especially climate change, is of particular importance. Therefore, the focus of this study is on the examination of predictors of student teachers' willingness to act in a climate-change mitigation and adaptation context. For the purpose of this study, measurement instruments of willingness to act in climate change mitigation and adaptation context, attitudes towards climate change, perception of action possibilities in climate change mitigation and adaptation context, interest in climate change and concern for ecological problems were validated. A total of 201 student teachers from the University of Rijeka (Croatia) participated in the study. It was determined that (I) attitudes towards climate change, (II) perception of action possibilities in climate change mitigation and adaptation context and (III) interest in climate change represent significant predictors of willingness to act in climate-change direction and mitigation contexts. Based on the results of this study, recommendations for teacher education in the climate change context have been offered.

Keywords: climate change; sustainable development goals (SDG); student teachers; education for sustainable development; action competence

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1. Introduction

Climate change represents a complex challenge of our times. It is known that natural as well as anthropogenic factors have an influence on variations in climate, i.e., that humanity's influence on the climate started during the beginning of Industrial Revolution. Moreover, climate change represents a complex topic as well as an issue at the global level with unpredictable consequences. Although evidence, as well as a consensus, exists in the scientific community regarding the causes and consequences of climate change on the future of humankind (Masson-Delmotte et al. 2021), different attitudes towards this issue are still present (Liu et al. 2015). Consequently, this situation leads to slow changes in behavior. A study conducted by Gatersleben et al. (2010) indicated that, on the one hand, a number of people simultaneously express high level of materialism and concern for climate change. Based on that, they concluded that behavioral changes are slow, despite the fact that society began to recognize climate change as a major problem. One of the potential explanations of these findings is "aridity" of climate change, which is present even among highly motivated individuals (Howell and Allen 2019). Additionally, Morton (2013) stated that additional explanations and studies of climate change can contribute to an (un)conscious delay of activities focused on climate protection. Therefore, focus should be put on adaptation as well as climate change mitigation strategies.

The Sustainable Development Solution Network just relisted Climate Action Edition 2021, in which they conclude that "this decade will define the course of people and the

planet far into the future, and it must be a Decade of Action . . . to bring about an inclusive, resilient, and net-zero world "(SDSN 2021, p. 7). Additionally, Sustainable Development Goal, Goal 13, is directly focused on Climate Action, whereby the UN calls for urgent action to combat climate change and its impacts, and Target 13.3 seeks to "Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.". Furthermore, European Parliament resolution from March 2019 states that youth education represents one of the most efficient ways of combating climate change.

Learning how to live with climate change represents both an ontological and existential task of newly defined understandings of what life actually is, what it means to live and how to live well, leading to the creation of new, sustainable lifestyles (Verlie 2019). It is important to urge not only students, but also people in general to participate more actively in what we refer to today as a "super wicked problems" (Lazarus 2008, p. 1153) as well as the hardest moral challenge (Hudson 2017). Learning how to cohabitate with climate change represents a new discipline of pedagogy, which confirms that climate change does not only represent "a condition which we should be ashamed of" or "a problem that has to be solved" (Hulme 2009, p. 364). Despite the fact that education for climate change is not sufficient to solve this problem, it still plays a key role in the switch towards a post-carbon world. Due to this fact, it is important to educate people in line with climate change pedagogy principles in order to adopt pro-ecological attitudes. At its core, education about climate change refers to learning during the period of risk, uncertainty, and rapid changes. People have never faced a situation similar to which they have to face today in the past, which raises the question of how to educate the youth about it. It is important to understand that climate change does not only represent a scientific problem, but also a complex social problem that requires more than pure content learning (McKeown and Hopkins 2010). Teachers have to have clear ideas regarding the problem as well ways in which they can deal with it in order to implement necessary changes into school curricula. Students who demand action on climate crisis have clearly stated "Our education system failed us. We are not adequately taught about climate crisis in our classrooms. Schools do not prepare us for the world which we will enter soon, instead, they prepare us for the jobs and society that is based on a system which created the crisis. We require an urgent reform of national curriculum as well as placing ecological crisis as our top educational priority" (Irwin 2020). This message clearly indicates that students are becoming aware of the seriousness of issues regarding climate change, whose harmful consequences they will have to suffer if we do not change our current behavior immediately. They do not want to become the victims of the current adult generation's selfishness which, in its short-term policies and reflections, does not take into account those who will succeed them. Consequently, they justifiably believe that education in its current form is inadequate. Clearly, a paradigm shift in the direction of transformative education is needed. Teachers should create educational environment in which transformative, student-centered teaching and learning is encouraged and eventually achieved. This challenge to (student) teachers best outlines the significance of their role in moving toward a sustainable future.

The need for (student) teachers to show a willingness to act towards the direction of sustainable development as well as a willingness to implement education for sustainable development (e.g., Sleurs 2008; UNECE 2012; Rauch and Steiner 2013; UNESCO 2020) is particularly emphasized due to the fact that education for sustainable development represents one of the key areas within which it is possible to make progress in climate change mitigation context. Therefore, an important question is being raised regarding the factors that shape (student) teachers' willingness to act in the direction of sustainable development as well as how to encourage it through teachers' initial training.

The results of previous research on climate change from the student teachers' perspective point out the fact that student teachers are mostly aware of the sustainable development issues at both the local and national level, while frequently underestimating the importance of global ecological problems such as climate change (Spiropoulou et al. 2007). While reflect-

ing on sustainable development as well as their role in shifting towards it, student teachers are mostly focused on its social dimension, while neglecting critical global topics as well as their role in coping with issues such as climate change (Koskela and Kärkkäinen 2021). One potential explanation for this situation can be found in the results of IEA International Civic and Citizenship Education Study from 2016 that revealed that percentages of teachers in Croatia reporting having participated in training courses on civic-related topics, namely the environment and environmental sustainability during pre-service and/or in-service training was only 28% (Schulz et al. 2018). Furthermore, Demant-Poort and Berger (2021) found that student teachers assess that they do not possess sufficient knowledge about climate change.

Although both policy documents (UNESCO 2015, 2017) and theoretical assumptions (e.g., Rauch and Steiner 2013; Sleurs 2008) put considerable emphasis in education for sustainable development on (student) teachers, who are perceived as potential agents of change needed for achieving sustainable development goals in the direction of sustainable future, it seems that they do not comprehend the importance of their own role in dealing as well as coping with sustainable development issues and problems such as climate change. Therefore, with climate change being one of the sustainable development's burning questions, the focus of this study is placed particularly on the examination of (predictors of) student teachers' willingness to act in climate change context.

1.1. (Predictors of) Willingness to Act in Climate Change Mitigation and Adaptation Context

Student teacher's willingness to act refers both to their intention and will to participate in significant and meaningful activities that bring desired changes in a sustainability context (Vukelić 2021). These activities can either specifically refer to student teacher's future professional actions such as implementation of certain education for sustainable development's aspects in their teaching or their general, daily actions.

In the context of climate change, actions one (intent to) exhibits usually fall into the following two broad categories: climate change mitigation and climate change adaptation (Chen et al. 2017). Climate change mitigation is aimed at minimizing the possible impacts of climate change, as well as tackling the causes of climate change. Climate change adaptation actions refer to altering our behavior and ways of life to protect the environment and overall wellbeing of planet and living beings. These actions are aimed at reducing the negative effects of climate change (Chen et al. 2017). In line with that, in this paper focus is placed on student teachers' willingness to act in climate change mitigation and adaptation context.

Action competence represents one of the key constructs while thinking about (teacher)'s willingness to act in climate change context or, in general, sustainable development (Breiting and Mogensen 1999; Jensen and Schnack 1997; Sass et al. 2020). At the individual level, action competence is defined as individual's latent capacity to act in the direction of sustainable development (Olsson et al. 2020). Sass et al. (2020) specify that a person possessing action competence is characterized by dedication and passion in dealing with sustainable development issues, knowledge regarding the problems in question, a critical but positive attitude towards various ways of solving the previously mentioned issues as well as trust in personal skills and capacities needed to create improved conditions. In other words, key components of action competence are willingness to act and perception of action possibilities (Breiting and Mogensen 1999; Mogensen and Schnack 2010; Sass et al. 2020).

Perception of action possibilities refers to individual's capacity to search for information and build network of knowledge based on the possibility to use personal list of activities in the direction of sustainable development, or in the context of this study, in the direction of climate change. Individuals have to understand which possible actions could be taken as well as how complex issues of sustainable development function (Kaplan and Kaplan 2009).

However, in order for student teachers to express willingness to act in climate change mitigation and adaptation context as well as switch toward sustainable future, multiple

motivational factors have to be present. Additionally, the same group has to become aware of the importance of understanding the possibilities to act. On the one hand, motivational factors include attitudes and interest in issues regarding climate change, while on the other hand, they involve perceptions of the future in climate change context as well as concern for the future.

In education for sustainable development, it is assumed that student teachers have to develop both skills and knowledge for sustainable development, and also express positive attitudes towards sustainability issues in order to become prepared to integrate and facilitate this type of education (Sleurs 2008; Rauch and Steiner 2013; UNESCO 2015, 2017). The abovementioned assumption is considered to be one of the perquisites for the successful implementation of education for sustainable development (Albareda-Tiana et al. 2018; Cebrián and Junyent 2015). It is expected that attitudes towards both supporting and accepting the idea of sustainable development, including climate change, form not only part of future practice, but also a subjective evaluation of student teacher's willingness to act in the direction of sustainable development through the implementation of education for sustainable development (Vukelić 2021). Additionally, not only do previous research results mostly indicate (student) teachers' relatively positive attitudes towards ecological topics (for example, climate change) (e.g., Boon 2016; Competente 2019), but they also indicate their relatively lower level of knowledge as well as numerous misconceptions regarding climate change (Boon 2016; Nyarko and Petcovic 2021; Seroussi et al. 2019).

In situations in which the interrelation between attitudes and consequential behavior is observed, not only do numerous conclusions of previous empirical studies remain vague, but contradictory findings also often occur. For example, on the one hand, results of previous studies support the existence of connection between attitudes towards ecological matters and pro-ecological behavior (e.g., Heimlich and Ardoin 2008; Hines et al. 1987), while on the other hand, certain studies, whose findings point out the lack of connection between attitudes and behavior or behavioral intention, can also be found (e.g., Chen 2010; Chen et al. 2010; Cleveland et al. 2012). Due to the vagueness of the conclusions of previous empirical studies, it is important to examine the predictive value of attitudes towards climate change in the prediction of student teachers' willingness to act in climate change mitigation and adaptation context.

Apart from attitudes towards climate change, student teachers' interest in this phenomenon also represents an important motivational factor that has to be considered as a potential predictor of willingness to act in climate change mitigation and adaptation context. Interest is closely connected with intrinsic motivation, i.e., it is a part of its core. In this context, an intrinsic motivation refers to individual's motivation to follow personal interest as well as to put effort into searching challenges which they find significant (Ryan and Deci 2000). In an attempt to explain factors that form pro-ecological behaviors, the significance of intrinsic motivation is often singled out (Steg et al. 2016; Van der Werff et al. 2013). Specifically, individuals who express an intrinsic interest in environmental protection matters, climate change mitigation or general sustainable development issues, and feel intrinsic responsibility for solving sustainability issues, behave pro-ecologically more often (Steg et al. 2016). Based on that, in this study, interest in climate change was identified as a potential factor of student teachers' willingness to act in the climate change mitigation and adaptation context.

It is believed that encouraging views oriented towards the future represents a precondition for the creation of society based on sustainable development (UNESCO 2020). Results of previous studies point out that individuals mostly experience climate change as something which will occur in the distant future without any consequences for them, which is ultimately related with a lack of motivation to behave pro-ecologically (Coulter et al. 2019; Jones et al. 2017). Therefore, by focusing on personal future, in which climate change poses a real threat, can lead to an increasing feeling of concern for ecological issues resulting in higher level of pro-ecological behavior (Lee et al. 2020). In other words, perception of (personal) future in climate change context as well as concern for the future represent one

of the key motivational factors that fuel both pro-ecological behavior and potential acting in the direction of climate change.

In research on education, studies that examine teachers' willingness to act in the climate change mitigation and adaptation context are scarce. For example, Seroussi et al. (2019) found that only a small number of participating teachers were ready to act in order to mitigate climate change. Moreover, the percentage of teachers who were willing to act is lower than the percentage of teachers who possessed sufficient knowledge regarding climate change. Additionally, Seroussi et al. (2019), found that their concern is connected with the intention to act in order to mitigate climate change. Based on that, in this study, the concern for ecological problems is identified as one of the potential predictors of willingness to act in the climate change mitigation and adaptation context.

1.2. Socio-Demographic Correlates of Willingness to Act in Climate Change Mitigation and Adaptation Context

While thinking about potential correlates of willingness to act in the climate change mitigation and adaptation context, it is necessary to consider potential effects of socio-demographic characteristics such as student teachers' gender and age. Namely, the results of previous empirical research indicate that the concern regarding the contribution to sustainable development as well as switching towards sustainable future differs depending on the individual's gender (Meinzen-Dick et al. 2014). Therefore, women express stronger positive attitudes towards sustainable development as well as higher level of willingness to act in the direction of environmental protection and general pro-ecological behavior (e.g., De Silva and Pownall 2014; Rončević and Cvetković 2016). The abovementioned differences are also present in education for sustainable development and the student teacher area where it has been continuously found that female student teachers express more positive attitudes towards environment and ecological topics, higher level of ecological literacy, clearer conceptions regarding sustainable development topics as well as a higher level of awareness about burning questions related to sustainable development such as climate change (e.g., Al-Naqbi and Alshannag 2018; Kilinc and Aydin 2013; Larijani 2010; Oerke and Bogner 2010; Tuncer et al. 2006, 2009; Vukelić 2021; Zelezny et al. 2000).

Apart from gender, student teachers' age also represents one of the potential socio-demographic correlates of their willingness to act in the climate change mitigation and adaptation context. Previous research on age differences in variables related to climate change (or any other sustainable development issue) are not only relatively scarce, but they also indicate markedly inconsistent results (Wray-Lake et al. 2010). Therefore, this study will try to answer the question of whether participants' age represents significant predictor of willingness to act in climate change mitigation and adaptation context.

2. Materials and Methods

The aim of this study was to examine predictors of student teachers' willingness to act in the climate change mitigation and adaptation context. Moreover, by reviewing relevant databases as well as studying literature on education for sustainable development, it was determined that this is a topic which is not only markedly scarce in international, but also completely neglected in national scientific discourse. A lack of focus on factors that form student teachers' perceptions regarding climate change is evident. Similarly, a lack of instruments constructed to measure the abovementioned perceptions is present. Thus, the first objective of this study was to examine the measurement characteristics of the measurement instruments used to measure various aspects of student teachers' perceptions regarding climate change. More precisely, the instruments were constructed and validated to measure (I) willingness to act in climate change mitigation and adaptation context, (II) attitudes towards climate change, (III) perception of action possibilities in climate change mitigation and adaptation context, (IV) perception of future in climate change context, (V) interest in climate change and (VI) concern for ecological problems. The second objective of this study was to examine which of the abovementioned factors

represent significant predictors of student teachers' willingness to act in climate change mitigation and adaptation context.

2.1. Sample

A total of 201 student teachers from the University of Rijeka (Croatia), out of which 78.6% of them were female, participated in the study. The study used convenience sampling. Participants' average age was 22.95 years (SD = 2.57). Online surveying was used in order to collect data. Prior to surveying, the participants were familiarized with the purpose of the survey as well as the anonymity of the given data. The participants needed around 10 to 15 minutes to complete the survey.

2.2. Instruments

Data on participants' socio-demographic characteristics, i.e., their age and gender, were collected. This study used questionnaires with the purpose of measuring the aspects of student teachers' perception on climate change: (I) Willingness to act in climate change mitigation and adaptation context scale (8 items), (II) Attitudes towards climate change scale (5 items) (III) Perception of action possibilities in climate change mitigation and adaptation context scale (4 items), (IV) Perception of future in climate change scale (7 items), (V) Interest in climate change scale (5 items) and (VI) Concern for ecological problems scale (10 items). The concern for ecological problems scale was adopted from Cifrić (2005). All the other used scales, i.e., its items, were adopted from Hadžiselimović (2015). The participants expressed their agreement with all of the items on a 5-point Likert scale (1—*I completely disagree*, 5—*I completely agree*).

All measurement instruments were validated, and their internal consistency was determined. For the purpose of this study, an exploratory factor analysis was used, and Cronbach's alpha coefficient of internal consistency (α) was calculated. Additionally, descriptive data were calculated (means (M) and standard deviations (SD) for all measures. Data were analyzed by using IBM SPSS 24.

In order to obtain initial factor solution for all measurement instruments, exploratory principal component analysis was carried out. The significance of KMO test as well as Bartlett's test of sphericity was calculated. For all measurement instruments, it was determined that KMO test was not significant ($p > 0.05$), while Bartlett's test showed statistical significance. The Guttman-Kaiser as well as Scree test criterion were used to determine the number of extracted factors. According to these criteria, one factor was extracted in every measurement instrument. Not a single item had a low factor loading (<0.3). Furthermore, Cronbach's alpha (α) coefficient values for all measurement instruments used in this research ranged between $\alpha = 0.7$ and $\alpha = 0.94$.

The results of an exploratory principal component analysis for all measurement instruments are shown below. Tables 1–6 show factor (structure) matrix and factor loadings for one-factor solutions for all measurement instruments as well as their descriptive data and coefficients of reliability.

For Willingness to act in climate change mitigation and adaptation context scale one factor that explains 50.37% of variance was extracted (Table 1).

For Attitudes towards climate change scale, according to Guttman-Kaiser criterion as well as Scree test criterion, one factor that explains 71.52% of variance was extracted (Table 2).

For Perception of action possibilities in climate change mitigation and adaptation context scale one factor that explains 52.72% of variance was extracted (Table 3). Prior to the creation of a simple linear composite, first as well as second item of the questionnaire were recoded as they carried opposite meaning compared to other items (marked with (R) in Table 3).

For Perception of future in climate change scale, according to Guttman-Kaiser criterion as well as Scree test criterion, one factor that explains 70.19% of variance was extracted (Table 4).

For Interest in climate change scale according to Guttman-Kaiser criterion as well as Scree test criterion, one factor that explains 68.75% of variance was extracted (Table 5). Prior to the creation of the simple linear composite, last item of the questionnaire was recoded as it carried opposite meaning compared to other items (marked with (R) in Table 5).

For Concern for ecological problems scale, according to Guttman-Kaiser criterion as well as Scree test criterion, one factor that explains 67.15% of variance was extracted (Table 6).

Table 1. Factor (structure) matrix and factor loadings for one-factor solution, coefficient of reliability and descriptive data for Willingness to act in climate change mitigation and adaptation context scale.

Item	Factor Loadings	M (SD)
(1) I am ready to self-initiatively do what it takes to mitigate climate change.	0.683	4.0 (0.87)
(2) I am ready to do what it takes in order to mitigate climate change if somebody would require me to do it (e.g., local government)	0.742	4.13 (0.92)
(3) Protecting climate represents a more significant task compared to others.	0.690	3.23 (1.02)
(4) I am ready to limit my future travels, especially by plane.	0.673	3.27 (1.09)
(5) I will try to learn as much as possible about climate change.	0.774	3.80 (0.91)
(6) Along with previous formal education (school and faculty), I am studying about climate change informally.	0.648	3.48 (1.10)
(7) I would like to teach about climate change at my future job.	0.746	3.35 (1.19)
(8) I intent to include the issue of climate change at my future job.	0.712	3.77 (1.11)
Explained variance	50.37%	
M (SD)	29.03 (5.81)	
Cronbach's α	0.86	

Table 2. Factor (structure) matrix and factor loadings for one-factor solution, coefficient of reliability and descriptive data for Attitudes towards climate change scale.

Item	Factor Loadings	M (SD)
(1) Climate change represents a very serious problem.	0.855	4.57 (0.69)
(2) Climate change represents a threat to my future wellbeing and safety.	0.782	4.07 (0.94)
(3) Climate change represents a threat to future generation, their lives and safety.	0.892	4.51 (0.69)
(4) Climate change represents a threat to humankind on planet Earth.	0.891	4.48 (0.76)
(5) Climate change represents a threat to all living beings on the Earth (including animals and plants).	0.803	4.53 (0.74)
Explained variance	71.52%	
M (SD)	22.16 (3.2)	
Cronbach's α	0.89	

Table 3. Factor (structure) matrix and factor loadings for one-factor solution, coefficient of reliability and descriptive data for Perception of action possibilities in climate change mitigation and adaptation context scale.

Item	Factor Loadings	M (SD)
(1) What I do as an individual will not help in mitigating climate change. (R)	−0.724	2.68 (1.20)
(2) We can't do anything to stop climate change. (R)	−0.791	1.84 (0.93)
(3) What we do can stop climate change from becoming even bigger problem.	0.713	3.84 (1.01)
(4) I believe I can persuade others to put effort into mitigating climate change.	0.671	3.22 (1.00)
Explained variance	52.72%	
M (SD)	14.54 (3.01)	
Cronbach's α	0.7	

(R)—reverse item.

Table 4. Factor (structure) matrix and factor loadings for one-factor solution, coefficient of reliability and descriptive data for Perception of future in climate change scale.

Item (In the Next 50 Years, . . .)	Factor Loadings	M (SD)
(1) . . . there will be more heat weaves, droughts and wildfires.	0.885	4.38 (0.76)
(2) . . . we are going to experience energy supply issues.	0.681	3.89 (0.98)
(3) . . . streets, tunnels and roads will get more frequently flooded.	0.854	4.10 (0.85)
(4) . . . we are going to experience more frequent and heavier storms.	0.886	4.17 (0.84)
(5) . . . we are going to experience more frequent health issues and epidemics.	0.775	4.12 (0.99)
(6) . . . (un)settled low-elevation coastal zones will get flooded due to storms and sea level rise.	0.858	4.22 (0.86)
(7) . . . we are going to experience heavy rainfalls and landslides.	0.903	4.18 (0.85)
Explained variance	70.19%	
M (SD)	29.08 (5.09)	
Cronbach's α	0.92	

Table 5. Factor (structure) matrix and factor loadings for one-factor solution, coefficient of reliability and descriptive data for Interest in climate change scale.

Item	Factor Loadings	M (SD)
(1) I would like to know more about climate change.	0.879	4.02 (0.97)
(2) I would like to know what I can do on my own for environment and climate protection.	0.867	4.23 (0.88)
(3) I would like to influence the decisions regarding climate change.	0.834	3.85 (1.07)
(4) I am interested in how to influence climate protection through international democratic decision-making process.	0.864	3.89 (1.16)
(5) I am not interested in problems related to climate change. (R)	−0.687	1.84 (1.04)
Explained variance	68.75%	
M (SD)	20.15 (4.23)	
Cronbach's α	0.88	

(R)—reverse item.

Table 6. Factor (structure) matrix and factor loadings for one-factor solution, coefficient of reliability and descriptive data for Concern for ecological problems scale.

Item (I Am Concerned about . . .)	Factor Loadings	M (SD)
(1) . . . air pollution.	0.768	4.39 (0.79)
(2) . . . accumulation of hazardous waste.	0.883	4.38 (0.86)
(3) . . . the influence of industry on environment and people's health.	0.893	4.42 (0.77)
(4) . . . extraction, destruction, and pollution of natural resources (forests, water, soil, oil)	0.830	4.49 (0.76)
(5) . . . the pollution of rivers, lakes, seas, and oceans.	0.853	4.64 (0.65)
(6) . . . the pollution of food and drinking water (preservatives, additives, pesticides . . .)	0.770	4.54 (0.75)
(7) . . . climate change in general.	0.754	4.34 (0.81)
(8) . . . forest dieback.	0.830	4.38 (0.81)
(9) . . . inadequate disposal of municipal waste.	0.827	4.43 (0.83)
(10) . . . the reduction of arable land (desertification, soil erosion, urbanization and traffic, sea level rise . . .).	0.828	4.27 (0.89)
Explained variance	67.15%	
M (SD)	44.28 (6.48)	
Cronbach's α	0.94	

3. Results

Table 7 shows the intercorrelations (Spearman correlation coefficient) between all composite variables as well as age (in years). A statistically significant correlation was

found between almost all variables. The only nonsignificant correlations were found between age and (I) perception of action possibilities in climate change mitigation and adaptation context, (II) interest in climate change, (III) concern for ecological problems as well as (IV) perception of future in climate change context.

Table 7. The correlation matrix between all composite variables and age.

Variables	Correlation Coefficients						
	1	2	3	4	5	6	7
1. Willingness to act	1	−0.11	0.61 **	0.57 **	0.67 **	0.59 **	0.45 **
2. Age (in years)		1	−0.27 **	−0.10	−0.10	−0.10	−0.09
3. Attitudes towards climate change			1	0.55 **	0.59 **	0.61 **	0.53 **
4. Perception of action possibilities				1	0.59 **	0.49 **	0.39 **
5. Interest in climate change					1	0.60 **	0.48 **
6. Concern for ecological problems						1	0.57 **
7. Perception of future							1

** $p < 0.01$.

A two-stage hierarchical multiple regression was carried out in which willingness to act in climate change mitigation and adaptation context represented dependent variable. Gender and age were implemented at stage one of the regression in order to control for socio-demographic variables. Attitudes towards climate change, interest in climate change, perception of action possibilities in climate change mitigation and adaptation context, perception of future in climate change context as well as concern for ecological problems were implemented at stage two.

The sample size of 201 student teachers was considered adequate given the seven independent variables included in the hierarchical multiple regression analysis. Due to the presence of statistically significant correlations between independent variables (Table 7), the assumption of multicollinearity was tested. The collinearity statistics (i.e., Tolerance and VIF) were all within accepted limits (Tabachnick and Fidell 2019) and therefore the assumption of multicollinearity was considered justified. The results of the hierarchical multiple regression are presented in Table 8.

Table 8. Results of hierarchical regression analysis for the estimation of willingness to act in climate change mitigation and adaptation context.

Variables	Model 1			Model 2		
	B	SE B	β	B	SE B	β
(constant)	29.27	3.86		0.81	3.52	
Gender	2.33	0.99	0.17 *	−0.59	0.69	−0.04
Age (in years)	−0.09	0.16	−0.04	0.07	0.11	0.03
Attitudes towards climate change				0.33	0.13	0.18 **
Perception of action possibilities				0.28	0.12	0.14 *
Interest in climate change				0.75	0.09	0.55 **
Concern for ecological problems				0.03	0.06	0.04
Perception of future				−0.03	0.07	−0.02
R^2	0.031			0.598		
F za R^2	$F_{(2,198)} = 3.116$ *			$F_{(7,193)} = 41.083$ **		

** $p < 0.01$; * $p < 0.05$.

The hierarchical multiple regression analysis revealed that at stage one, socio-demographic variables (gender and age) contributed significantly to the regression model ($R^2 = 0.03$, $F_{(2,198)}$

= 3.17; $p < 0.05$) and accounted for 3% of the variance in willingness to act in climate change mitigation and adaptation context. Participants' gender represents the sole statistically significant predictor. Women express higher level of willingness to act in climate change mitigation and adaptation context.

During stage two of hierarchical regression analysis, the remaining potential predictors of willingness to act in climate change mitigation and adaptation context were implemented. It was determined that predictors explain significant 59.8% of variance in willingness to act in climate change mitigation and adaptation context ($R^2 = 0.598$, $F_{(7,193)} = 41.08$; $p < 0.001$). More specifically, it was determined that predictors statistically significantly explain additional 56.8% of variance in willingness to act ($\Delta R^2 = 0.568$; $F_{(5,193)} = 54.58$; $p < 0.001$) along with variance explained by participants' gender and age. Additionally, (I) attitudes towards climate change, (II) perception of action possibilities in climate change mitigation and adaptation context as well as (III) interest in climate change represent significant predictors of willingness to act in climate change mitigation and adaptation context.

After implementing other predictors into the model in stage two of the analysis, gender no longer represented significant predictor of willingness to act in climate change mitigation and adaptation context. Therefore, regardless of their gender, student teachers who have positive attitudes towards climate change, perceive action possibilities in climate change mitigation and adaptation context (they believe that is possible to influence climate change mitigation and adaptation) as well as those who show interest in climate change, express higher levels of willingness to act in the climate change mitigation and adaptation context.

4. Discussion

The first objective of this study was to examine the instruments' measurement characteristics. By examining the measurement characteristics, very satisfactory validity and reliability measures were obtained. The exploratory factor analyses performed resulted in very satisfactory values and obtained Cronbach alpha values indicate satisfactory reliability of measurement instruments.

The second objective of this study was to examine the predictors of student teachers' willingness to act in climate change mitigation and adaptation context.

Based on the results of previous research (e.g., Al-Naqbi and Alshannag 2018; Kilinc and Aydin 2013; Tuncer et al. 2006, 2009; Vukelić 2021), participant's gender consistently represented a significant predictor of student teachers' variables related to sustainable development, or in this case, willingness to act in climate change mitigation and adaptation context. However, after implementing other predictors in the regression model, gender no longer represented a significant predictor of willingness to act in climate change mitigation and adaptation context. The absence of the contribution of gender to the explanation of variance in willingness to act in climate change mitigation and adaptation context after implementing other predictors into the model indicates the idea that effect of gender on willingness to act is completely mediated by attitudes towards climate change, perception of action possibilities in climate change mitigation and adaptation context as well as interest in climate change. Therefore, an additional examination of the previously mentioned variables' potential mediational effects on the interrelation between gender and student teachers' willingness to act in climate change mitigation and adaptation context should be conducted in future research. Other than that, it should be mentioned that the obtained sample had an uneven gender ratio, which could contribute to the lack of predictive power of gender in explaining student teachers' willingness to act. During the sampling process, it was achieved that participants' gender ratio represents ratios that exist in student teacher population, i.e., teachers. To be more specific, it is common that the teacher population is primarily female. According to the OECD data for Croatia 78% of teachers are women (OECD 2019). In line with that, in this study, 78.6% of participants were women. However,

this could have had an effect on the lack of statistical significance of the gender—willingness to act relationship.

Moreover, regarding socio-demographical correlates, it was shown that age does not represent a statistically significant predictor of willingness to act in climate change context. If we consider the results of previous empirical studies, it is possible to notice that significant age differences in variables related to sustainable development are either scarcely found or often small (Wiernik et al. 2013). In line with these findings, age did not represent a significant predictor of student teachers' willingness to act in climate change mitigation and adaptation context in this study.

On the one hand, it was determined in this study that (I) attitudes towards climate change, (II) perception of action possibilities in the climate change mitigation and adaptation context as well as (III) interest in climate change represent significant individual predictors of willingness to act in climate change mitigation and adaptation context. On the other hand, perceptions of the future in climate change context as well as concern for ecological problems did not represent significant predictors of student teachers' willingness to act. One potential explanation of these results lies in the fact that participants' evaluations on both scales are quite high (means of its items are above 4) along with limited response variability. In other words, more or less all participants believe that climate change will represent ever-increasing problems in the future, and they express their concern for ecological problems. However, these beliefs do not motivate them to act (or to express willingness to act) in the climate change mitigation and adaptation context. Instead, what motivates their willingness to act in climate change mitigation and adaptation context are their attitudes towards climate change, perception of action possibilities in climate change mitigation and adaptation context as well as interest in climate change. Therefore, student teachers who have positive attitudes towards climate change, perceive action possibilities in climate change mitigation and adaptation context (they believe that it is possible to influence climate change mitigation and adaptation) as well as those who show interest in climate change, express higher levels of willingness to act in the climate change mitigation and adaptation context.

The obtained results point to the conclusion that attitudes towards climate change represent significant positive predictors of willingness to act in climate change mitigation and adaptation context, which is in accordance with insights form the sustainability sciences that often emphasize the role of attitudes in explaining various types of human behavior in the direction of sustainable development (e.g., Evans et al. 2007; Heimlich and Ardoin 2008). Therefore, a list of models that explain the interrelation between ecological knowledge, attitudes and pro-ecological behaviors exists in sustainable development ecological dimension area. For example, Kaiser et al. (2008) developed a pro-environmental competence model in which they define the interrelation between environmental knowledge, attitudes towards sustainable development ecological dimension topics as well as various types of pro-ecological behavior. Kaiser et al. (2008) emphasize that attitudes towards the environment represent a key predictor of pro-ecological behavior to a significantly larger extent compared to knowledge. In line with these facts, it was determined in this study that student teachers who express more positive attitudes towards climate change also express higher levels of willingness to act in climate change mitigation and adaptation context.

Furthermore, interest represents another motivational factor that explains student teachers' willingness to act in the climate change mitigation and adaptation context. This result is in accordance with previous empirical findings, which indicate that intrinsic interest in sustainable development ecological issues and problems leads to a higher level of various pro-ecological behavior (Steg et al. 2016; Van der Werff et al. 2013). In situations where student teachers express an interest in issues regarding climate change, and find these topics interesting and important, they express higher level of willingness to act in the climate change mitigation and adaptation context. In this context, the finding of McNeal et al. (2017), which states that interest in environmental issues, especially climate change,

represents one of the key motivational factors in implementation of content about climate change in teachers' professional work, is particularly interesting.

Apart from attitudes and interest in climate change, perceptions of action possibilities in climate change mitigation and adaptation context also represents a significant predictor of willingness to act in climate change mitigation and adaptation context. Therefore, student teachers who believe that it is possible to influence climate change and act in order to mitigate them, express higher level of readiness to take action. From the theoretical perspective, it is interesting that the perception of action possibilities represents one of the key predictors of willingness to act. Namely, according to the experts who explore action competence for sustainable development (e.g., Breiting and Mogensen 1999; Mogensen and Schnack 2010; Sass et al. 2020) these two constructs represent key components of action competence. Previous theoretical notions on action competence did not encompass the examination of interrelation between abovementioned components, instead, they were based exclusively on their description (e.g., how an individual who expresses willingness to act in climate change direction functions). Due to the fact that interrelation between two key components of action competence was determined, the results of this study can offer a supplement to the construct in question. Additionally, this finding has potential implications for educational activities focused on encouraging the development of action competence. In other words, if we want the person to express willingness to act in the direction of sustainable development (or, more specifically, climate change), it is important to encourage the development of their awareness about various action possibilities in the abovementioned direction as well as empower their confidence in personal influence needed to make positive changes.

It is important to single out several key limitations of this study. First, one key limitation of this study is that its sample included exclusively student teachers studying at just one Croatian university. Second, due to abovementioned national and regional limitation of the sample, it is not possible to draw stronger conclusions regarding the predictors of student teachers' willingness to act in climate change mitigation and adaptation context. Therefore, in future research, we do not only recommend the expansion of the sample of participants to other Croatian universities, but also to include a multicultural sample in order to determine whether the obtained results explain student teachers' willingness to act in climate change mitigation and adaptation context at international level. Apart from that, willingness to act in climate change mitigation and adaptation context probably represents a dynamic construct, which changes over time depending on various factors that form it. In order to determine the development of student teachers' willingness to act in the climate change mitigation and adaptation context more clearly, it is important to conduct longitudinal studies that will encompass the phenomenon in different development phases. Finally, in this context, the experts should monitor the development of student teachers' willingness to act during their participation in teacher's initial training, particularly in programs focused on training student teachers for implementation of education for sustainable development as well as teaching about climate change.

5. Conclusions

The aim of this study was to examine predictors of student teachers' willingness to act in the climate change mitigation and adaptation context. According to the results of this study, regardless of their gender, student teachers who have positive attitudes towards climate change, perceive action possibilities in the climate change mitigation and adaptation context (they believe that is possible to influence climate change mitigation and adaptation) and those who show interest in climate change, are more willing to act in the climate change mitigation and adaptation context.

An apparent need exists for training student teachers to teach about climate change. Additionally, they should be empowered in order to shift towards climate change mitigation and adaptation.

In line with the results of this study, the recommendation is to raise student teachers' awareness regarding the action possibilities as well as influence they can have on climate change mitigation and adaptation during their initial teacher training programs. It is particularly important to show student teachers the methods and models they can use in order to cope with challenges of today's world, especially climate change. Apart from that, it is important to place emphasis on encouraging the development of student teachers' positive attitudes and interest in climate change. Additionally, through educational interventions focused on the abovementioned aspects, we can ensure that student teachers feel more prepared to act in the climate change mitigation and adaptation context, which will, consequently, have a positive effect on both their (future) students as well as lead to a general shift towards a more sustainable future by implementing education for sustainable development.

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