

Article

Local Renewable Energy Development: School Teachers' Perceptions, Attitudes and Teaching Intentions

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Abstract: This study investigated factors that might influence teachers' intention to choose Renewable Energy Sources as an optional module. The research involved 454 Greek teachers working in the archipelagos of the southern Aegean region in Greece, an area with significant potential for the development of Renewable Energy Sources (RES). This potential however remains largely unexploited partly due to local community reluctance towards RES development in the area. Although renewable energy education is considered to be necessary for further RES development, RES are not among teachers' first choice as an environmental module. We found that, despite teachers demonstrating highly positive attitudes towards RES, they consider local communities to be rather non-supportive of local RES development. A relationship between teachers' moderate intention to teach RES and teachers' perceptions of locals as non-supportive towards RES was found. We also found that local teachers feel more competent to teach about RES than non-local teachers. The latter are more motivated to comply with social pressure than locals. These findings emphasize the need for renewable energy education policy makers to take into account local communities' role in influencing the teaching of RES and to provide teachers with the appropriate skills in order to competently handle potential oppositions.

Keywords: teachers; Renewable Energy Sources; perceptions; attitudes



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1. Introduction

Due to the intensity of climate change, the most immediate and reliable solutions to meet energy needs within the context of a sustainable future are proposed measures for improving energy efficiency and harnessing Renewable Energy Sources (RES). However, despite the current shift and the positive outlook towards RES, the potential of RES, and especially non-hydro renewable energy technologies, remains low [1]. Energy research has highlighted several factors, such as technological, economic, environmental, institutional, socio-cultural issues, that are involved in energy transition based on RES [2]. Public acceptance, as demonstrated by local communities, appears to be a crucial factor [3,4]. This also occurs because the novel RES energy system results in significant changes with regard to the geographic distribution of energy generation plants; because the RES energy system is decentralized to a certain degree, contact points are multiplied among communities and RES plants, resulting in far more direct involvement of local communities [5,6]. In this context, however, local communities present a psychological paradox. Thus, while maintaining positive attitudes towards RES, they do not wish the respective infrastructures to be established in their own areas [7].

The above-mentioned paradox is a challenge for education, which is considered to be a social driver for energy transition toward clean energy [8], and especially for renewable energy education (RES education), which has been considered in recent decades to be a key

factor for fostering public acceptability towards RES [9,10]. Consequently, RES education may assume a special role in communities that may make an energy transition by installing production units locally in their area. In such cases, the purpose of RES education is not only for local communities to accept the importance of RES in general, but to accept the importance of RES development within their own location. RES educators need to address the factors that influence local communities' acceptability of RES. According to the literature, these factors may be related to various issues such as concern that RES infrastructure will aesthetically damage the landscape [11] and increase bird population mortality [12], that it will not be profitable [13], that RES produced energy will become more expensive [14], that there will be limited transparency between the local community and the investors [15,16], or that there might be even deeper, psychological reasons, such as place-related values [17].

In these circumstances, perceptions and attitudes of teachers who are invited to engage in RES education in areas where there is caution and suspicion regarding RES installations is of particular interest. This is because teachers are members of local communities; thus, as citizens, they may share the local attitudes towards local RES development. In general, study of the perceptions and attitudes of teachers' who are expected to undertake RES education is inadequate. Research conducted to date has shown that teachers have positive attitudes towards RES [18,19], understand their benefits [20], have introduced them in their teaching only to a limited extent [21], and would like to see RES more highly represented in the curriculum [22]. However, they face challenges, such as work load and lack of training, which prevent them from teaching a non-mandatory learning unit on RES [10]. Teachers also appear to have some misconceptions or insufficient knowledge about RES [23–25]. Another study also showed that male teachers are more knowledgeable about RES than female teachers [26].

The present study focused on attitudes and perceptions towards RES of teachers who work on islands in the region of the Dodecanese in the Aegean Sea, Greece. This region has significant potential for RES, particularly wind and solar; however, the contribution of RES is limited and energy needs in the area are still met by oil-fired thermal power stations, which are both expensive and polluting [26–30]. There are several technical constraints that hinder RES transition, such as weak and old electrical grids and significant seasonal variation of the electrical energy demand [27]. With regard to social factors, local communities' reactions to RES installations, especially wind parks and the exploitation of geothermal fields (where there is relative potential, such as the case of Nisyros island), appear to be generally cautious [29,31,32]. Negative attitudes and suspicion are often linked to efforts attempted in recent decades to install large wind farms in restricted regions [33]. Another factor that needs consideration is the distinctive relationship between islanders and place, a relationship which effects how their cultural identity is formed. Any landscape change, for example the construction of wind farms, may cause change in the relationship between one and place, and consequently in one's self-perception [34,35]. This situation makes successful local RES education an even greater challenge.

In addition, it should be noted that RES education for Greek secondary education is implemented through two approaches. Regarding the first approach, RES education is mainly integrated into the curriculum of subjects such as Physics, Technology, and Geography, focusing on general and technical aspects of RES function. Regarding the second approach, RES education is implemented through seminar-type modules with a duration of 1 or 2 h per week depending on students' age, during which teachers can freely choose environmental education topics among other possible alternatives, such as health, culture, or vocational options for the 7–9th year, and humanities and social sciences, art and culture, or sciences for the 10–12th year. Therefore, RES education is one among many options in the field of Environmental Education. These optional environmental programs are the only opportunity that allows the teacher to investigate the challenges and peculiarities that RES development presents for an insular community. However, after processing the data regarding environmental education programs implemented in the 98

secondary schools of the Dodecanese region for a period of five consecutive school years (2012–2017), we found that the topic of RES is significantly less popular than other topics, such as recycling. Specifically, for the school years from 2012–2013 to 2016–2017, among the 322 environmental education school programs that were implemented in Dodecanese secondary schools, only 28 programs were within the RES field [36].

The combination of the facts presented above, namely that the Dodecanese islands have abundant RES potential, that local community expresses resistance towards RES, and that RES education remains an optional topic which is not very popular for secondary education teachers, sparked an interest for the current study, which attempts to investigate determining factors behind teachers' intention to teach an RES-related topic for a school program. Finally, no research in the international literature exists that focuses on this group of teachers who are invited to teach RES in areas where RES infrastructures are being resisted. In these types of local environments, which vary from indifferent to hostile towards RES, it is interesting to identify how teachers position themselves towards local RES development and the degree to which they intend to be involved in RES-related educational activities. For this purpose, an adapted model of planned behavior [37,38] was selected, as it is a widely accepted model for studying factors that influence behavioral intentions, with the behavior in question being "choosing a RES related topic for a school program" [34]. The factors that were examined were teachers' perceptions and attitudes towards RES' local development, teachers' perceptions regarding their control of teaching RES school programs (i.e., whether teachers believe they have sufficient knowledge or relevant educational material in their possession, factors that would facilitate a possible RES teaching), their perception of the external norms regarding RES (i.e., how teachers perceive local communities' outlook of local RES development), their motivation to comply with these external norms, and their intention to choose RES-related topics for a school program.

It should be noted that planned behavior theory includes normative beliefs (as a behavioral predictor), which refer to how the group's expectations are perceived by the individual. Normative beliefs, together with the degree to which the person is motivated to comply with them, determines the subjective norm, which, in turn, connects with how the individual perceives social pressure to fulfill a certain behavior, or not [39]. This study measured how teachers perceive local community RES attitudes expressed by citizens, local authorities, and local media, with the focus on determining whether teachers under peer pressure, or under the perceived social norm, find the local community to be supportive of RES. Similarly, [39] succinctly define a social norm as a collective perception of the appropriateness of a specific action.

Within this framework, our research questions are the following:

1. What are teachers' perceptions and attitudes towards local RES development?
2. How do teachers perceive local communities' perceptions towards local RES (expressed by citizens, local media, and authorities) and to what degree are they motivated to comply with local communities' stances?
3. To what degree do teachers perceive they are competent enough and intend to teach RES as a module?
4. Whether and how do demographic characteristics (gender, age, place of residence, master's degree, and service position (school principals or teachers)) differentiate the sample?

2. Materials and Methods

The research population consisted of 1660 permanent and supplementary secondary education teachers of the Dodecanese Prefecture, from all scientific fields, who taught classes during the 2016–2017 school year. The survey included teachers of all fields, because all teachers in secondary education can choose, design, and implement RES-related educational activities within the context of environmental education programs.

The study was conducted through a questionnaire of 130 closed-ended items, which was developed from three sources: the initial literature review findings, the guidelines for

constructing a measurement instrument according to planned behavior theory [38], and the results of 38 secondary teacher interviews conducted within the Dodecanese region (thus from the same population), as a preliminary study. The qualitative research [40] indicated that teachers maintain highly positive perceptions regarding potential local RES development, although issues that raised concerns, especially with regard to socio-political and economic aspects, were noted. Teachers however, perceived local communities to be hostile to any local investment in RES and they admitted that the local communities' non-supportive outlook towards local RES acted as a disincentive for them to choose RES as a teaching topic.

To increase validity, the original version of the questionnaire was submitted to seven secondary education teachers for a pre-testing phase. Descriptive statistics (M. and 95% C.I.) are presented. For group comparisons and correlations [41,42], composite variables were computed from all the items measuring each dimension. Regarding reliability, all composite variables were found to have Cronbach α of at least 0.882 (Table 1).

Table 1. Internal consistency of scales.

Scale	Cronbach α
Perceptions	0.891
Attitudes	0.958
External norms	0.882
Motivation to comply	0.951
Perceived behavioral control	0.891
Intention	0.944

The questionnaire was developed on a Google form and remained accessible for two months until enough entries had been collected. Data selected to be presented here autonomously addresses specific research goals. Presented initially are 20 items on teachers' perceptions regarding RES local development, which consist of 8 items on teachers' perceptions regarding RES' environmental impact, 4 items regarding RES' technological impact, and 8 items regarding RES' socio-economic impact. Next, questions on teachers' attitudes regarding RES local development (8 items), on how teachers perceive external norms regarding RES as expressed by the local community, media, and authorities (11 items), on teachers' motivation to comply with the particular external norm (8 items), are presented. Finally, the degree to which teachers feel they control potential teaching of RES school programs (6 items), and 7 items on teachers' intention to choose RES-related topics for optional school programs, are discussed. All the above items are connected to the planned behavior model and the research questions, as shown in Table 2. With the exception of the control variables, which were nominal, for the items a seven-point Likert scale was used, with 1 corresponding to 'strongly disagree' and 7 to 'strongly agree'.

Table 2. Questionnaire and research questions.

Dimension	Number of Items	Planned Behavior Model	Research Questions
Teachers' perceptions regarding RES environmental impact	8 items	Behavioral Beliefs	Question a
Teachers' perceptions regarding RES technological impact	4 items		
Teachers' perceptions regarding RES impact socio-economic impact	8 items	Attitudes	Question a
Teachers' attitudes regarding RES	8 items		
Teachers' perceptions on how the local community stands regarding RES (split in two axes, a. citizens and b. media and authorities)	11 items	Subjective Norms	Question b
Teachers' motivation to comply with local community	8 items	Motivation to comply	Question b
Teachers' perceived control regarding RES teaching	6 items	Perceived Behavioral Control	Question c
Teachers' intention to choose RES as a teaching topic	7 items	Intention	Question c

Of a population of 1660 teachers serving in secondary education of Dodecanese Region, Greece, 454 teachers responded, with a return rate of 27% on the total population. A description of the research sample is presented in Table 3.

Table 3. Description of sample.

Control Variable	N	%
Gender	294	64.76% male
	160	35.24% female
Age	50	11.01% 25–35 years
	162	35.68% 36–45 years
	200	44.05% 46–55 years,
	42	9.25% 56–67 years
Position of responsibility	340	74.89% teachers,
	76	16.70% school principals
	38	8.4% vice principals
Local residency	244	53.30% local residents
	210	46.70% non local residents
Master degree	210	46.30% non master graduates
	244	53.70% master graduates, of which:
	51	11.20% master degree relevant with environmental education

3. Results

The results of the survey summarized below are ordered in accordance with the structure of the survey questionnaire. These are, furthermore, accompanied by corresponding figures that present the mean scores of each question cluster. The vertical axis (Y) lists the seven-level Likert scale values that participants were invited to complete. The horizontal axis (X) briefly lists questions of each cluster. The simple error bar graph with 95% confidence interval was selected in order to indicate the degree of uncertainty for each reported measurement.

3.1. Teacher Perceptions on RES' Local Development

The items measuring perceptions of RES local development are divided into three categories: items focusing on the environmental impact, items focusing on the technological impact, and items focusing on the socio-economic impact. Regarding RES' environmental impact (Figure 1), teachers widely believe that RES is connected with a cleaner environment ($M = 6.58$, $SD = 0.83$) and that RES is a clean form of energy production ($M = 6.53$, $SD = 0.92$). Teachers also believe that RES will contribute to the preservation of islands' natural beauty ($M = 5.84$, $SD = 1.50$) and to handling climate change impact and its effect on the islands ($M = 5.42$, $SD = 1.22$).

Perceptions of RES' possible negative environmental impact on local communities are clearly less widespread. There is little support of the perception that RES infrastructure will result in land use conflicts ($M = 3.09$, $SD = 1.44$) or that local flora and fauna will be degraded ($M = 3.00$, $SD = 1.42$). Finally, the perception that the landscape will change due to RES has a moderate acceptance ($M = 3.81$, $SD = 1.89$).

Regarding RES' technological impact (Figure 2), teachers strongly believe that RES is the answer to limited traditional fuel resources, which will sooner or later come to an end ($M = 5.68$, $SD = 1.56$). Regarding RES' energy supply sufficiency, teachers believe that RES can provide sustainable energy capable of meeting local needs, without limitations ($M = 5.80$, $SD = 1.43$). Specifically, they believe that RES can provide energy security to local communities because the latter will no longer depend on external energy producers and providers ($M = 5.89$, $SD = 1.29$) and that the islands can—through RES—be autonomous in terms of energy production and energy distribution ($M = 5.76$, $SD = 1.46$). It is worth mentioning that our items measured both positive and negative aspects of RES perceptions,

in an attempt to include a wide representation of relevant literature. For analysis purposes, reverse coding was used, where applicable.

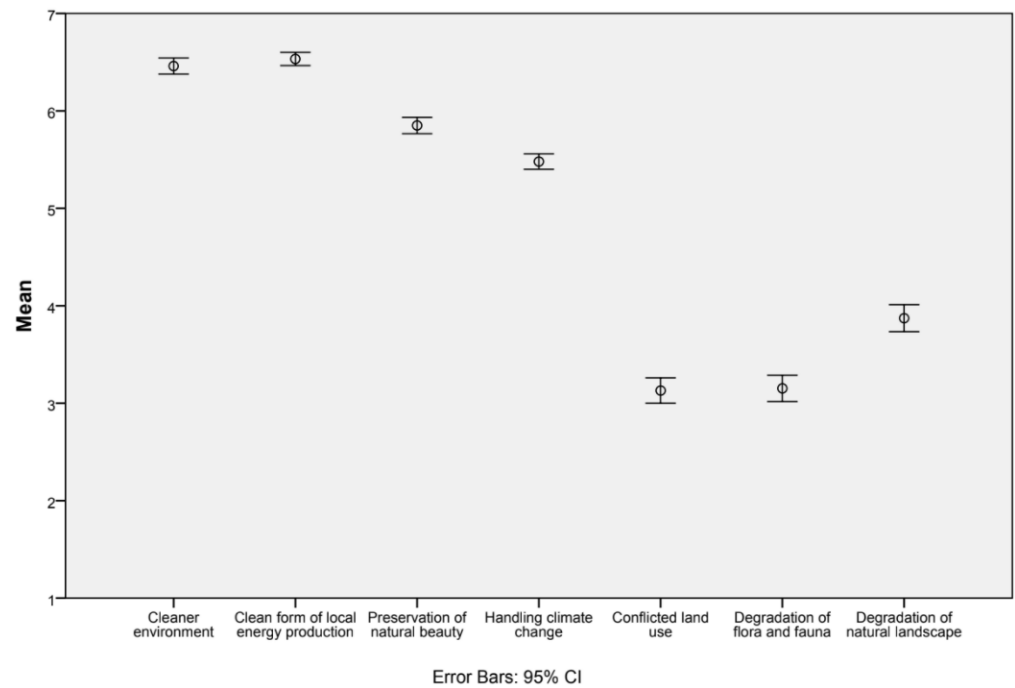


Figure 1. Perceptions on RES' environmental impact.

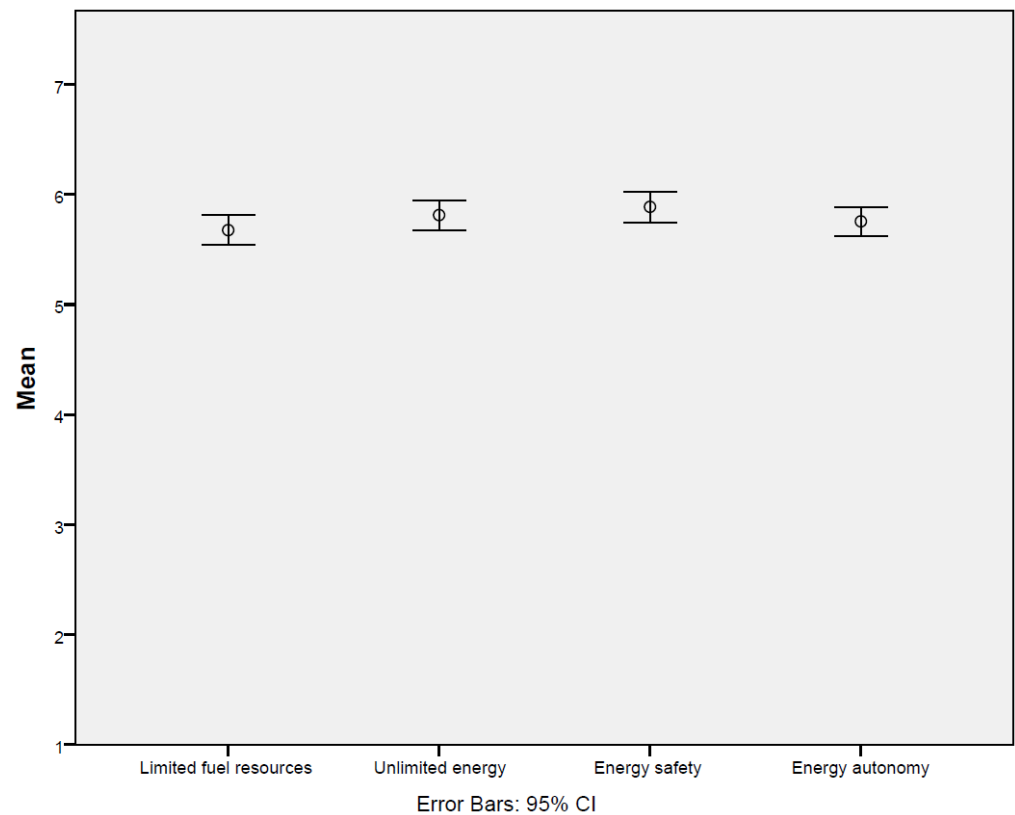


Figure 2. Perceptions on RES's technological impact.

Regarding RES' socio-economic impact (Figure 3), teachers generally believe that RES will result in economic benefits for the islands. They are nevertheless suspicious of companies that will install and financially exploit RES infrastructures, and they mistrust

the state's role. Specifically, it is widely accepted that local development of RES will economically benefit the local community ($M = 5.92$, $SD = 1.17$). Furthermore, teachers believe that—through local development of RES—new jobs will be created for locals ($M = 5.41$, $SD = 1.37$). Teachers also believe that, via RES' local development, electricity prices will decrease for the local community ($M = 5.37$, $SD = 1.37$) and that the local community can even profit by selling energy to third parties ($M = 4.91$, $SD = 1.56$). At the same time, however, there is a strong belief that state-owned RES infrastructures will be subjects of poor administration ($M = 5.72$, $SD = 1.35$) and that RES' local development will only serve private sector's interests ($M = 5.40$, $SD = 1.66$). Slight reservations are also expressed that RES installations may require non-affordable installation and maintenance costs that may even make the investment unviable ($M = 4.39$, $SD = 1.54$). However, despite the perceptions that RES will benefit the local community, teachers also believe that RES' installations would be incompatible with local citizens' place-related values, because residents' local identity may be altered and is thus vulnerable ($M = 5.15$, $SD = 2.14$).

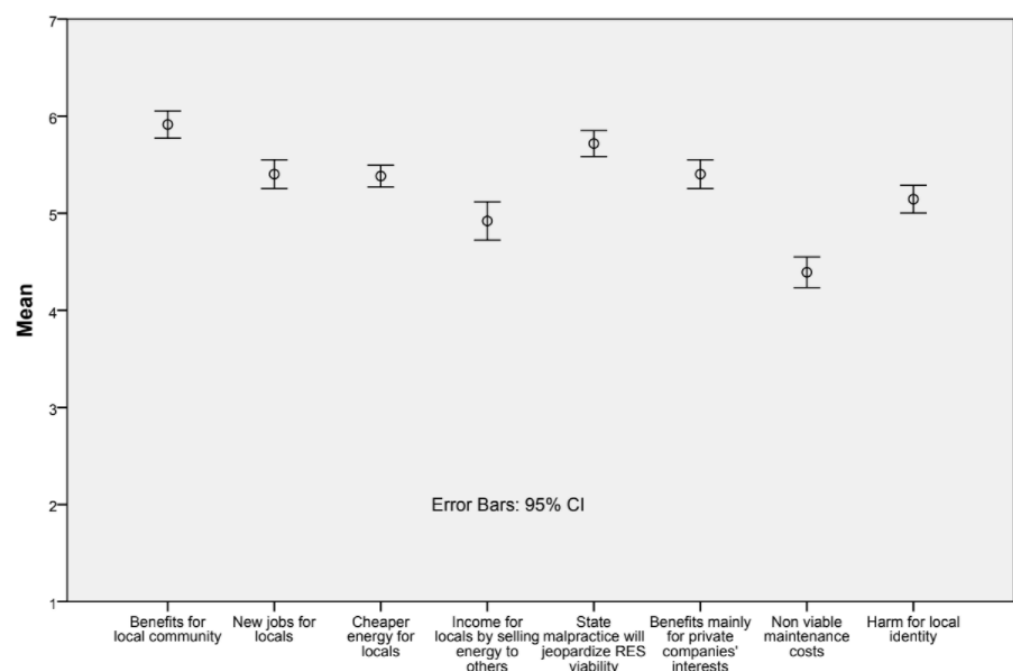


Figure 3. Perceptions on RES's socio-economic impact.

3.2. Teachers' Attitudes about RES' Local Development

Teachers maintain very positive attitudes towards possible RES' development on the island where they work ($M = 6.35$, $SD = 1.11$), stating that if a local referendum on RES was to take place, they would vote in favor ($M = 6.29$, $SD = 1.06$). In addition, teachers state that regarding future municipality elections, they would vote for a party that promises to invest in RES ($M = 6.16$, $SD = 1.19$). They also stated that when they watch a TV debate regarding RES' local development, they align themselves with those in favor of RES ($M = 6.10$, $SD = 1.18$). They rejoice when they read an article in the local press promoting RES' local development ($M = 6.07$, $SD = 1.25$) and, when discussing the potential local development of RES, they try to find arguments in favor ($M = 5.96$, $SD = 1.24$). The teachers also stated that they would support a campaign that promotes RES' local development ($M = 6.05$, $SD = 1.24$) and that they would actively participate in a voluntary public awareness campaign focusing on RES' benefits ($M = 5.75$, $SD = 1.46$) (Figure 4).

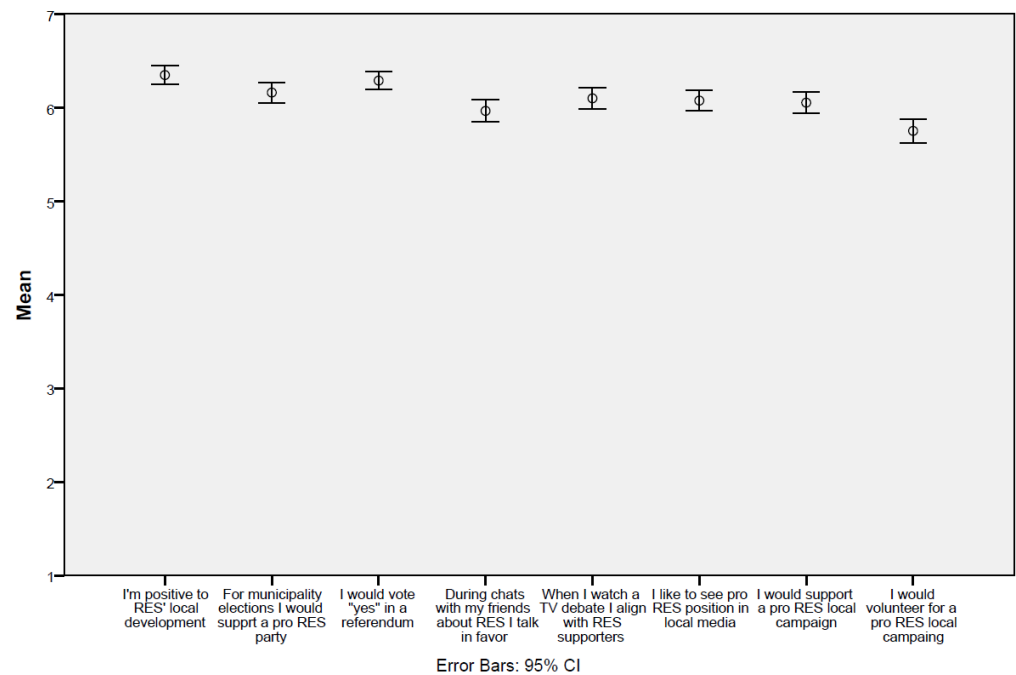


Figure 4. Attitudes towards RES (a).

These very positive attitudes towards RES' local development are countered by some terms that teachers would like to see as pre-requirements (Figure 5). Specifically, teachers appear undecided regarding whether RES facilities should only be placed at a distance, far away from residential areas ($M = 4.39$, $SD = 1.71$), should only occur if new jobs are created for locals ($M = 4.13$, $SD = 1.56$) or if the local community has a share of the RES profits ($M = 4.51$, $SD = 1.52$), and if (the local community) actively participates in the investments' planning phase ($M = 4.47$, $SD = 2.07$). These factors scored mean values of around 4, which is in the middle of the scale.

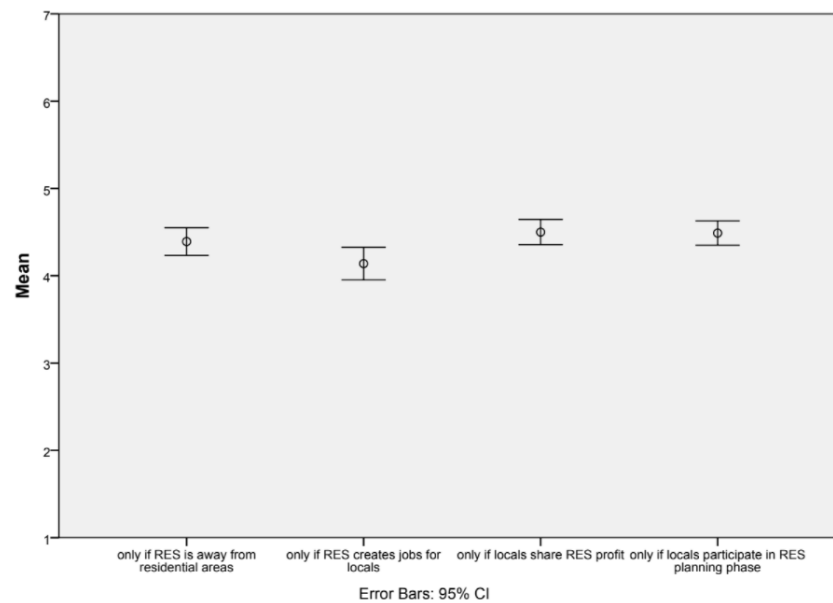


Figure 5. Attitudes towards RES (b).

3.3. Local Community's Norms towards RES

Teachers' perception of how the local community feels towards RES differs vividly compared to teachers' own perceptions towards the issue (Figure 6). Teachers appear undecided whether the local community is in favor of RES development ($M = 4.15$, $SD = 1.48$)

and whether, in the event of a referendum, the local community would vote in favor of RES local development ($M = 4.17$, $SD = 1.45$), scoring with mean values of around 4. The belief that the local community would vote for a mayor that promoted RES' development is unpopular ($M = 3.97$, $SD = 1.44$). On the contrary, it is widely accepted that the local community is indifferent to RES' development ($M = 5.62$, $SD = 1.61$), and/or that it is suspicious of such a prospect ($M = 5.40$, $SD = 1.60$). The beliefs that RES remains a controversial issue that provokes reactions among the local community ($M = 5.54$, $SD = 1.67$), and that RES is furthermore a source of conflict for the local community ($M = 5.31$, $SD = 1.65$), are widespread.

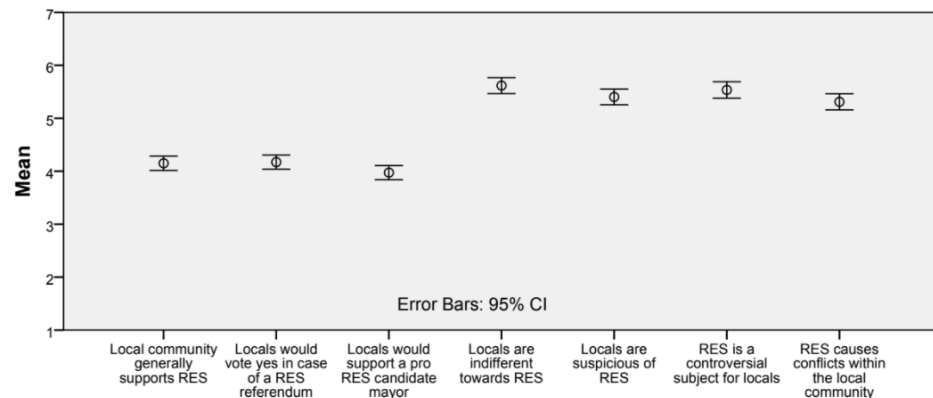


Figure 6. Local community's norms towards RES, expressed by citizens.

Teachers similarly perceive local authorities are indifferent towards RES' local development ($M = 5.53$, $SD = 1.76$) (Figure 7). However, it should be mentioned that teachers do not support the idea that local authorities deliberately impede RES' development ($M = 3.82$, $SD = 1.71$). Regarding local media, teachers maintain different perceptions, mainly believing that the media actively try to cultivate readers' positive attitudes towards RES ($M = 5.35$, $SD = 1.23$), informing the audience about RES' advantages ($M = 5.23$, $SD = 1.26$).

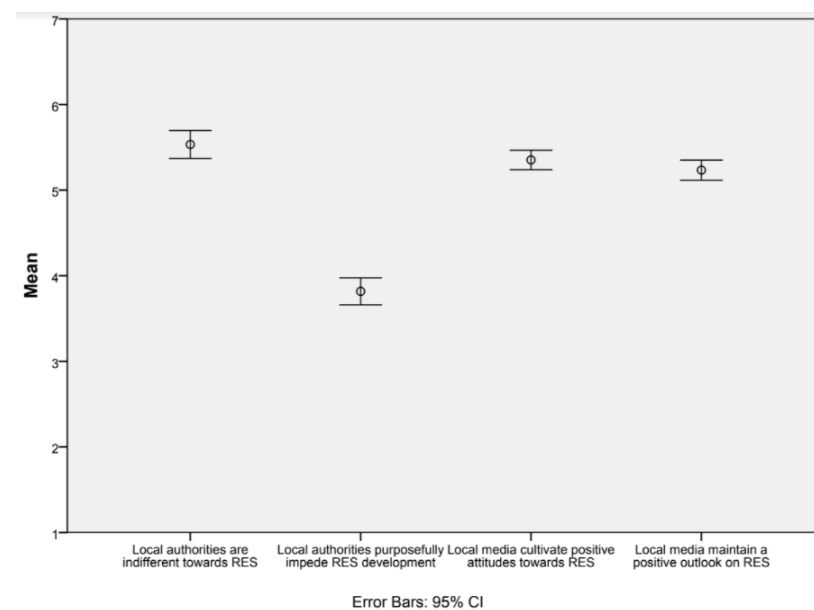


Figure 7. Local community's norms expressed by local authorities and local media.

3.4. Teachers' Motivation Compliance with External Norms

Teachers' perceptions regarding local communities' norms about RES influence their teaching choices (Figure 8). The communities' norms appear to play an important role in teacher choices, as they clearly prefer to choose teaching topics towards which local

community has positive attitudes ($M = 5.56$, $SD = 1.59$). Thus, local community's positive interest towards RES would be a strong incentive for teachers to incorporate the topic into their teaching praxis ($M = 5.95$, $SD = 1.09$). Teachers' willingness to deal with local issues is also influenced by local authorities' attitude on each issue ($M = 5.02$, $SD = 1.92$) and less by the local media's position ($M = 4.98$, $SD = 1.95$). In the same context, teachers state that the local community's expressed opposition would be rather a disincentive in their teaching choice of RES as an optional topic ($M = 5.13$, $SD = 2.02$). This also applies if the local community is divided on the topic ($M = 4.98$, $SD = 2.15$), or if it considers it to be dilemmatic ($M = 4.81$, $SD = 2.23$). Local residency also slightly influences teachers' choices because teachers would not opt for a topic closely connected with local community's issues if they are not locals themselves ($M = 4.54$, $SD = 2.32$).

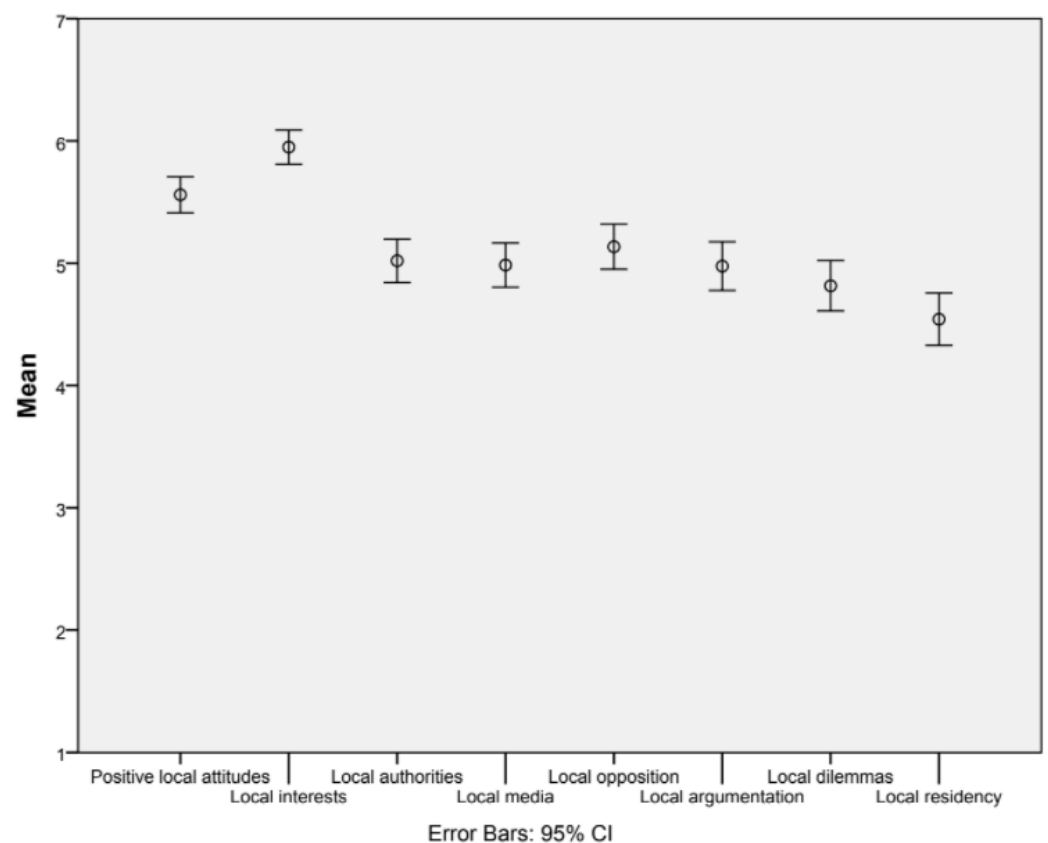


Figure 8. Motivation to comply.

3.5. Teachers' Perceptions of RES's Teaching Control

Regarding teachers' perceptions about their degree of control of possibly teaching an RES-related school program (Figure 9), although teachers feel that they are generally aware of RES-related issues ($M = 5.35$, $SD = 1.41$), they appear to have moderate confidence in their ability to teach RES-related topics. In particular, they believe that they marginally possess both the knowledge necessary to teach an RES-related topic ($M = 4.77$, $SD = 1.77$) and the relevant educational material ($M = 4.45$, $SD = 1.77$) required to successfully teach a RES educational program. Similarly, teachers assess their confidence to teach RES topics as marginally positive ($M = 4.78$, $SD = 1.98$), with similar scores regarding their readiness ($M = 4.74$, $SD = 1.98$) and their familiarity with teaching this specific topic ($M = 4.57$, $SD = 1.96$).

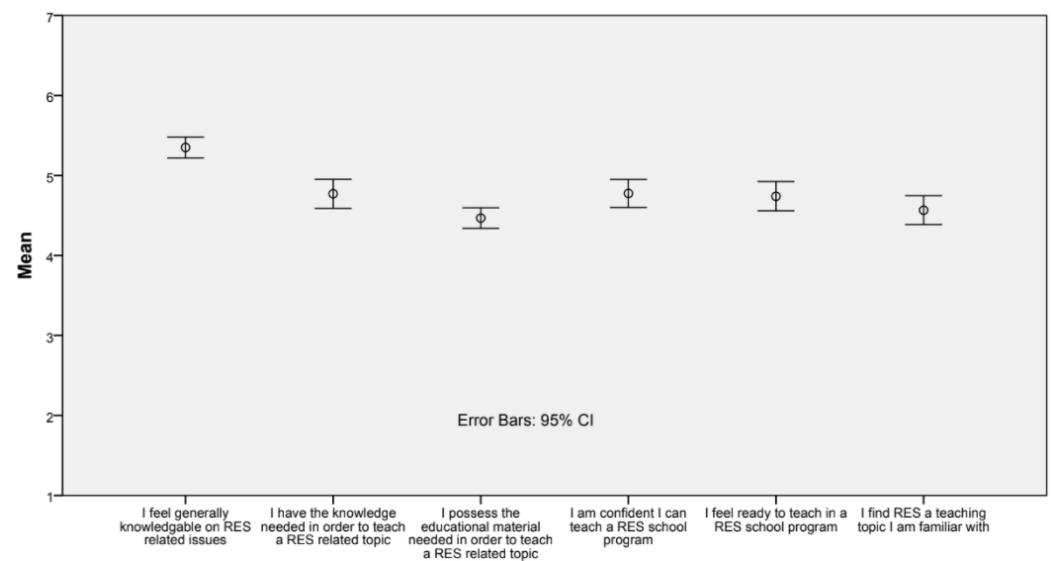


Figure 9. Teachers' perceptions of RES's teaching control.

3.6. Teachers' Intention to Teach RES-Related School Programs

Regarding teachers' intention to teach RES-related topics (Figure 10), although teachers appear to be very interested ($M = 5.15$, $SD = 1.55$), they are inconclusive regarding whether to include RES in their immediate plans as a possible optional teaching topic ($M = 4.12$, $SD = 2.01$), or to encourage colleagues to undertake RES teaching programs ($M = 4.02$, $SD = 1.77$). Teachers' willingness to obtain training in order to cope with a RES teaching topic is equally constrained ($M = 4.52$, $SD = 1.52$), and collecting RES-related educational material is obviously low ($M = 3.72$, $SD = 1.69$), indicating that RES is not a very popular optional topic. Moreover, teachers' intention to participate in RES-relevant training is just marginally positive ($M = 4.21$, $SD = 1.94$). Nevertheless, they are very motivated to collaborate with colleagues in a RES-related school program ($M = 5.70$, $SD = 1.47$).

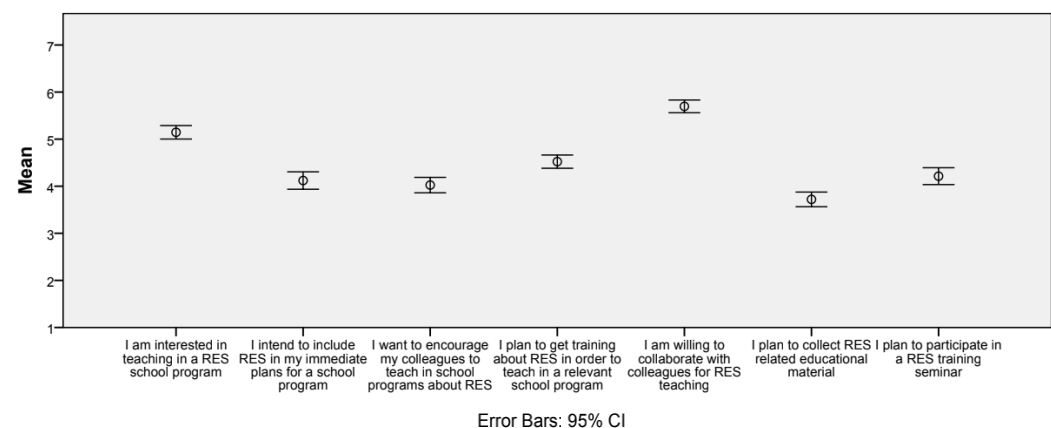


Figure 10. Intention to teach RES.

3.7. Group Comparisons

Regarding teachers' perceptions about RES, gender and master's-level education significantly differentiated the sample. In more detail, the means for males ($M = 5.98 \pm 1.18$) and females ($M = 6.19 \pm 0.93$) were significantly different ($t(452) = 1.948$, $p = 0.002$), with females maintaining significantly more positive perceptions regarding RES' local development than males. In addition, the means for master graduates relevant with the field of environmental education ($M = 6.37 \pm 0.76$) and for non-graduates ($M = 6.05 \pm 1.08$) were significantly different ($t(452) = 2.133$, $p = 0.023$), with graduates maintaining more positive perceptions regarding RES' local development than non-graduates. No significant differ-

ences were found among these subgroups, regarding either teachers' attitudes towards RES or perceived local communities' RES outlook.

Regarding the motivation to comply with external norms, local residence and teachers' position significantly differentiated the subgroups. Local residency significantly differentiated the motivation to comply ($t(452) = 2.016, p = 0.043$), with locals being less motivated to comply ($M = 4.90 \pm 1.88$) than non-locals (5.26 ± 1.79). Moreover, vice-principals ($M = 5.69 \pm 1.74$) are significantly more motivated to comply than principals ($M = 4.61 \pm 1.87$), $F(2, 452) = 4.531, p = 0.011$, but, as the Tukey post hoc test showed, neither differentiated significantly with teachers ($M = 5.08 \pm 1.84$) with $p > 0.104$ for both comparisons.

Regarding teachers' perceived control of RES teaching, gender, local residence, and master studies proved to differentiate the subgroups. Male teachers ($M = 4.85 \pm 1.69$) perceive themselves more in control of a potential RES teaching outcome compared to female ($M = 4.40 \pm 2.02$) and this difference was significant $t(452) = 2.513, p = 0.000$. Moreover, local residents feel more in control ($M = 4.93 \pm 1.73$) than non-locals ($M = 4.44 \pm 1.89$), $t(452) = 2.956, p = 0.004$. Finally, environmental education master study graduates ($M = 5.95 \pm 1.05$) are significantly more in control than non-master graduates ($M = 4.39 \pm 1.87$), $t(452) = 5.710, p = 0.000$.

Regarding the intention to teach RES as an optional module, age, position, local residence, and master studies yielded significant differences. Teachers in the age group 46–55 are more motivated to choose RES for a school program (4.18 ± 0.20) than teachers in the age group 25–35 (4.18 ± 0.20), $F(3, 451) = 3.970, p = 0.008$, but as the Tukey post hoc test showed there were no significant differences among other age groups. Similarly, principals are more motivated to choose RES for a school program (4.98 ± 0.13) than both vice-principals (4.24 ± 0.23) and teachers (4.50 ± 0.75). Vice-principals and teachers did not differentiate among themselves, $p = 0.517$. Local residents are more motivated to choose RES for a school program (4.27 ± 0.95) than non-locals (4.24 ± 0.23), $t(452) = 4.207, p = 0.037$. Finally, teachers with master studies relevant to environmental education are more motivated to choose RES for a school program (5.69 ± 0.13) than those with non-relevant master studies (4.34 ± 0.91), $t(452) = 6.484, p = 0.000$.

3.8. Correlations

There was a statistically significant relationship between intention to teach an RES-related topic and all variables examined in this study. More specifically, there was a statistically significant, moderate positive correlation between intention to teach an RES topic and perceptions, $r(452) = 0.34, p < 0.001$, with perceptions explaining 11% of the variation in intention. There was also a moderate positive correlation between intention and attitudes, $r(452) = 0.49, p < 0.001$, with attitudes explaining 24% of the variation in intention. There was a strong positive correlation between intention and perceived control, $r(452) = 0.58, p < 0.001$, with perceived control explaining 33% of the variation in intention. The correlation between intention and local community was weak and negative, $r(452) = -0.10, p < 0.005$, with local community explaining 1% of the variation in intention. Finally, there was a moderate negative correlation between intention and motivation to comply, $r(452) = -0.30, p < 0.001$, with motivation to comply explaining 9% of the variation in intention (Table 4).

Table 4. Pearson correlations.

	Intention	Perception	Attitudes	Perceived Control	Local Community
Perceptions	0.342 **				
Attitudes	0.493 **	0.768 **			
Perceived control	0.589 **	0.110 *	0.226 **		
Local community	-0.100 *	0.082	0.093 *	0.338 **	
Motivation to comply	-0.307 **	0.070	-0.183 **	-0.159 **	0.346 **

Note. ** = statistically significant at $p < 0.01$ level, * = statistically significant at $p < 0.05$ level.

4. Discussion and Conclusions

RES education can play an important role in the transition to a new energy model. This role is even more crucial in areas where local communities appear to be hesitant regarding local RES development. The subject of this study is such a case. Focus was placed on the Dodecanese, an archipelago in the South Aegean, Greece, where the significant potential for RES development remains largely unexploited. We analyzed the perceptions and attitudes of 454 secondary school teachers regarding local development of RES, their perceptions of local communities' views on the subject, and how the local community can affect RES education and, ultimately, teachers' intention to teach RES education in the context of school environmental education programs.

According to the research results, teachers appear to generally have positive perceptions regarding the local development of RES. They are confident about the environmental benefits that RES can provide for the islands in terms of lack of pollution and mitigation of dealing with climate change. However, they appear to have hesitations about the impact RES may have on the natural landscape. They are convinced that RES have the technological capacity to satisfy the energy needs of island communities and that RES will generally benefit local communities, especially in economic terms, by creating new jobs and reducing energy prices. Their attitudes towards the local development of RES are also highly positive, as they state that they would support the development of RES in every way. The positive perceptions and attitudes of secondary education teachers in the Dodecanese regarding the local development of RES confirm findings from relevant previous studies [18,19].

However, these generally positive perceptions and attitudes are not unconditioned. Teachers are highly suspicious of both the public and private companies who will oversee RES installation and operation and, partially, of the financial viability of such an investment. They also set conditions regarding the location and the participation of the local community in both the planning phase and the exploitation phase. These are all standard demands, as found in other relevant studies in Greece and elsewhere [15,16,43]. Teachers are equally cautious about a possible changing of a place's identity due to RES installation. This issue is related to an individual's "internal geography" and the fact that space is a factor that also forms human identity [44]. However, all of these difficulties can be overcome, as demonstrated by the good practice on Tilos Island, a small island in the Dodecanese, which recently turned towards a successful RES investment, with high local acceptance [27,45].

Teachers' positive perceptions and attitudes regarding RES appear to be in contrast with the corresponding attitudes of local communities. Local communities' hesitant position towards RES, as reported in the literature [29,31,32], was indirectly confirmed by how teachers perceive local community attitudes. Thus, teachers firmly believe that the local development of RES is a controversial issue for the locals and/or that the locals remain indifferent or even suspicious regarding RES local development. They emphasize the indifference shown by the local authorities on this issue, whereas they consider that the attitude of the local media is more positive. This is an interesting finding because it highlights the distance between teachers' personal perceptions and attitudes, and their perceptions of the stance of the local community.

Another interesting finding of this study is the deviation between teachers' perceptions of RES and teachers' intention to teach RES. Teachers maintain highly positive attitudes and perceptions regarding RES' impact, but there is a rather weak intention to choose RES as an optional teaching topic. This finding is also consistent with the relevant statistical data [36]. Two impeding factors appear to contribute to this gap: teachers perceived control of teaching RES and teachers' motivation for compliance with communities' attitudes on RES. More specifically, teachers perceive their control of teaching RES to be average, which underlines the need for teachers' RES training and provision of educational material, as stressed by previous studies [18,46]. Moreover, teachers perceive that local communities are indifferent or negative towards RES, a perception that significantly demotivates them from choosing RES as an optional teaching topic. Within this framework, teachers state

clearly that they actively avoid choosing optional teaching topics that the local community opposes or even finds dilemmatic. This finding raises an important issue for RES education. The complex nature of increasing RES acceptance from local communities can only be approached through synergies of different cognitive domains that encompass both the natural and the social sciences. However, learning about places' RES history and future vision, and about communities' relevant narratives, is not something teachers are willing to do. In turn, this has an impact on how relations are formed between schools, communities, and their places, and the quality of learning [47]. Similarly, [48] (p. 6) underline the need for teachers to be "community-minded" or "community ready", so that they can adjust to the continually changing place-based classroom contexts, and can thus align with the equally continual changes in the social and cultural community contexts.

Demographic parameters also revealed interesting findings. In particular, regarding gender, males perceive themselves as more capable of teaching RES programs than females. This finding is consistent with previous findings about gender differentiation [26]. By comparison, females were found to maintain more positive perceptions about RES than males. Teachers who are also local citizens of the island where they work are more motivated to teach in RES programs than non-local citizens, and feel more in control regarding RES teaching. Thus, locality is an important parameter for RES education. Environmental Education-related master's degrees graduates maintain significantly more positive attitudes towards RES than non-graduates, they feel significantly more able to teach RES programs, and are significantly more motivated to teach in RES programs. This finding confirms the need for RES training for teachers to be willing and able to successfully implement RES programs. In terms of teachers' position, school principals are significantly more motivated to teach RES programs than teachers, opening a discussion about how authority facilitates approaching a topic that is opposed by the local community. Finally, regarding the age of the teachers, the youngest (25–35) showed the lowest intention to choose RES programs compared to their older colleagues (46–55). Older teachers may feel more confident in dealing with topics that are resisted by the local community.

Finally, Pearson correlations demonstrate that teachers' perceived control of RES teaching is highly positively correlated with their intention to choose RES as an optional teaching topic, whereas teachers' attitudes about RES are slightly lower. This result was expected and aligned with previous research [16]. An interesting novel finding is that the highest negative correlation regarding teachers' intention to teach RES is the motivation to comply with local communities, followed by a slightly lower correlation of local communities' stance towards RES. It therefore appears that connecting learning with communities can work better in the fields in which there is convergence between the teachers and the local community on the subject in question. When topics are seen as controversial, place-based pedagogy faces significant obstacles. This intensifies when the teacher does not belong to the local community, i.e., when he/she is not a citizen of the island where he/she works. In particular, teachers who do not permanently reside in the local community where they work systematically avoid addressing controversial topics. The finding that social norms influence teacher teaching choices regarding RES has broader research implications. Similar research can be conducted on various topics that provoke social reactions, such as sex education or the refugee crisis [40].

Our study provided interesting data on RES education for regions that show certain reluctance towards RES development. A survey of the remaining levels of education, and the distinction between the different forms of RES (mainly wind and solar, which are abundant in the region), would provide more specific results. In conclusion, as an optional topic for Greek secondary education, RES will remain marginal unless teachers are equipped with the appropriate skills to competently handle opposition within the local community and policy makers take into account the role the local community plays in effective RES teaching. As [48] state "it is clear that community-based service learning in a range of diverse contexts can be a catalyst for transitions and transformations". For further RES development to be achieved, a transition and transformation of local com-

munities' attitudes towards RES is needed. It would be useful for the current research to be expanded to incorporate other possible factors that could have an impact on teachers' intention to teach RES-related topics. Furthermore, local communities, which are faced with sustainability issues such as RES installation and energy use, can play a critical role in becoming "laboratories" in which students can receive training about decision and policy making. Although local and small-scale action is not sufficient to mitigate some national or global issues, teachers may use these "labs" to pilot innovative teaching methods and provide students with necessary competences needed to effectively influence grand scale sustainability policies. In this regard, advanced teacher training is needed [49] so that teachers may be well prepared to deal with complex global issues.

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