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Pre-Service Teachers' Knowledge, Participation and Perceptions About Environmental Education in Schools

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Abstract Despite the ever-growing body of knowledge about human impact on the environment and the need to work towards a sustainable future, participation in environmental action initiatives among the general population remains low. There is an increasingly urgent need to develop a culture of participation among young people who in turn may become future leaders. This article describes a study that was undertaken to investigate pre-service teachers' environmental knowledge, their willingness to participate in environmental initiatives, and their perceptions about environmental education in schools. The study participants were pre-service teachers between the ages of 19 and 22. Data were collected through online surveys, followed by focus group interviews where pre-service teachers were given the opportunity to expand and comment on the survey responses. Findings from this study are consistent with previous research on pre-service teacher literacy, attitudes, perceptions and participation. However, the pre-service teachers' perceptions about the role of schools and adults in nurturing environmental awareness and active participation among youth provides educators with new insights for the development of a more comprehensive environmental education curriculum that focuses on integration of theory and action.

> *Our communities will only reach their potential as vibrant and healthy places when youth are welcomed as full participating members. (Warner, Langlois, & Dumond, 2010, p. 95)*

The environmental challenges confronting the world today require active participation by all citizens. Finding ways to engage youth as full participants and leaders in environmental initiatives is critical to ensuring a more sustainable future. This article reports on the findings of a study that was undertaken in order to gain an understanding of

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the environmental knowledge held by pre-service teachers, their willingness to participate in environmental initiatives, and their perceptions about environmental education in schools. Specifically, the study looked at: (a) pre-service teachers' perceptions about their own level of environmental knowledge and their willingness to participate in environmental initiatives; (b) how they acquired environmental knowledge; and (c) the perceptions they have about how environmental awareness should be nurtured in school.

The idea to embark on this study was triggered by my professional observations that very few Bachelor of Education (undergraduate) pre-service teachers participated in the Environmental and Outdoor Education Club (EOEC) that was founded by a former student in 2009. I was invited to be the faculty advisor for the club when it started. During the first year of its inception, the total club membership consisted of only three pre-service teachers, who organised environmental action initiatives and invited other students to participate. At the beginning of each academic year, the club committee members hold a membership drive and plan environmental action initiatives for the year.

Despite the recruitment efforts and seemingly engaging activities that are planned, only a handful of pre-service teachers fully participate in the club activities each year. The following questions came to mind as I contemplated my observations of limited participation in the student-run environmental education club over the past 3 years:

1. Why are only a few pre-service teachers interested in participating in the EOEC activities?
2. What other environmental initiatives do pre-service teachers participate in?
3. Is participation or lack of participation related to pre-service teachers' levels of environmental knowledge?
4. What other factors influence pre-service teachers' level of commitment to participate in the EOEC or any other environmental activities?

In order to answer these questions, I designed and administered an online survey, followed by focus group interviews. All Bachelor of Education pre-service teachers who normally receive the invitation to participate in the EOEC were invited to participate in the study. Prior to describing the research methodology, I discuss existing literature and research central to the identified research area.

Environmental Knowledge, Attitudes and Practices of Pre-Service Teachers

Teachers play a key role in environmental literacy of future generations (World Commission on Environmental Development, 1987; McKeown & Hopkins, 2002) and they are most influential in educating children and teenagers to be future leaders in protecting the environment (Esa, 2010). Teachers are more likely to produce students who are more environmentally literate if they are more knowledgeable, have positive attitudes towards the environment, and show concern for environmental problems (Tuncer et al., 2009). If teachers lack proficiency in their environmental knowledge, skills and commitment, it is unlikely they will be able to effectively lead environmental change in schools (National Environmental Education Advocacy Council, 2005; Yavetz, Goldman, & Pe'er, 2014). Research has shown that inadequate incorporation of environmental education within Teacher Education programs is one of the obstacles to successful implementation of environmental education in schools (Cutter & Smith, 2001; McKeown & Hopkins, 2002; UNESCO, 1997; Yavetz et al., 2014).

Several researchers revealed that prospective teachers do not possess the desired knowledge and understanding, and have misconceptions regarding complex issues such

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as the greenhouse effect, ozone layer depletion and acid rain (Boyes, Chambers, & Stanisstreet, 1995; Dove, 1996; Groves & Pugh, 1999; Khalid, 2003). In a study designed to assess Greek pre-service primary teachers' knowledge, attitudes and self-reported behaviour towards marine pollution issues, Boubonari, Markos, and Krevrekidis (2013) reported that pre-service teachers demonstrated a moderate level of knowledge about marine pollution issues. Earlier on, Spiropoulou, Antonakai, Kontaxakaki, and Bouras (2007) had reported how limited knowledge about the environment among Greek primary pre-service teachers resulted in low rates of implementation of environmental programs in schools. Similarly, Esa (2010) reported that lack of environmental knowledge among students and teachers is believed to contribute to lack of pro-environmental behaviours.

Several research studies looking at pre-service teachers' attitudes, knowledge and behaviour generally revealed positive attitudes, limited environmental knowledge and low levels of environmental behaviour (Boubonari et al., 2013; Michail, Stamou, & Stamou, 2007; Pe'er, Goldman, & Yavetz, 2007; Stir, 2006; Tuncer et al., 2009). Studies conducted in Australia and Turkey reported that pre-service teachers were very concerned about environmental issues and scored high on attitude factors, but they possessed minimal knowledge regarding environmental issues and expressed a lack of confidence in their ability to make wise decisions or take appropriate action (Boubonari et al., 2013; Stir, 2006). Another study showed that prospective teachers in Turkey expressed positive attitudes towards the environment as well as a high degree of concern about environmental problems, despite their low levels of knowledge on current environmental issues (Tuncer et al., 2009). Similarly, a study of Israeli pre-service teachers revealed limited knowledge and positive attitudes towards the environment (Pe'er et al., 2007). These researchers viewed pre-service teachers' positive attitudes as a reflection of their awareness and desire to identify with what they intuitively accept as correct values, regardless of their limited knowledge. On the other hand, Chapman and Sharma (2001) noted a lack of environmental awareness among student teachers that they attributed to the theoretical way in which the environmental education was taught.

The literature highlighted above shows the prevalence of positive environmental attitudes among pre-service teachers. Other research has highlighted a negative correlation between attitudes and taking action. Esa (2010), for example, reported that, although Malaysian biology pre-service teachers possessed good knowledge of many environmental concepts and had positive attitudes towards the environment, these were not fully translated into pro-environmental behaviours. Similarly, a study of Taiwanese secondary teachers reported that although teachers expressed moderate-to-very positive environmental attitudes, they felt they were less skilled in political and legal action for environmental protection (Hsu & Roth, 1998). On the other hand, a more recent study of Greek pre-service teachers showed that they scored moderately high on individual action and low on collective action (Boubonari et al., 2013). What this means is that the pre-service teachers expressed a strong sense of being able to have positive influence on the environment through individual actions such as turning off lights, closing faucets/taps and purchasing environmentally friendly products, as opposed to taking political action such as writing letters to the media, reporting to local authorities or participating in environmental organisations.

Environmental Education in Schools

The goal of environmental education programs in schools is to foster responsible environmental behaviour and to provide students with the opportunity to actively participate and work with adults to implement change (Salter, Venville, & Longnecker, 2011).

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Researchers have reported on the importance of school-wide environmental education as a forum for students to voice their opinions and to achieve change (Rickison, 2001; Rickison, Landholm, & Hopwood, 2009). Environmental education programs in schools do not often give students such opportunities (Hart, 2008). However, Cutter-Mackenzie (2010) has reported on a more recent cultural shift in some Australian schools and programs to embrace environmental education and sustainability action process. There is a need for more research that provides information about the extent of such a cultural shift.

When considering participation as part of the education curriculum, translating theory into practice is critical to empowering young people to fully participate in their communities (Youniss & Levine, 2009). In order to develop an enduring understanding about the environment, students need to be given opportunities to: (a) develop ownership of the environmental knowledge they learn from the curriculum; (b) engage in concrete experiences as an integral part of environmental education courses; (c) work on action projects dealing with environmental issues in their communities; and (d) participate in policy and decision making processes (Gwekwerere, 2011; Matthews & Taylor, 1999; Orr, 2004).

Participation should not only be seen as something students do as an extension of their classroom learning; rather, it is more effective when it is integrated in the learning process by engaging teaching perspectives that view learning as occurring within a community (Lave & Wanger, 1991). Reid and Nickel (2008) provided an analysis of different teaching and learning perspectives and showed how cognitive and situative teaching strategies place participation at the centre of learning. Teaching that engages students to participate within a community is more likely to prepare them to become initiators and engaged participators, compared to teaching based purely on individualistic learning approaches.

The aim of environmental education in the school curriculum is to shape young people's perceptions and values about human impact on the world, and to ensure development of a sustainable future. However, there does not seem to be a clear relationship between the knowledge people possess and their involvement in environmental initiatives (Madruga & da Silveira, 2003; Matthews & Taylor, 1999). Lack of participation in environmental initiatives among youth has been attributed to several reasons, including: (a) a weak foundation of young people's opinions when it comes to understanding science and technology and how it affects their lives; (b) individual resistance to behaviour change, including behaviours that lead to environmental protection; (c) overwhelming and unprecedented levels of environmental and social destabilisation worldwide, which makes individual action seem insignificant; and (d) fewer opportunities provided for youth to engage in discussions and expression of their ideas about social and environmental issues in adult-dominated institutions (Madruga & da Silveira, 2003; Matthews & Taylor, 1999). Literature has also shown how participatory approaches related to decision making about social change are replete with issues of power and control (Reid, Jensen, Nickel, & Simovska, 2008; Reid & Nickel, 2008).

Existing research has revealed varying levels of care and participation among teenagers as it concerns the environment and their desires to make a difference (Foutz, Hall, Luke, & Mayhew, 2011; Warner et al., 2010). Studies of primary and secondary school children in India, the Philippines and Australia have revealed that although the students did not have a deep understanding of environmental issues and lacked environmental awareness and attitudes necessary for protecting the environment, they had great concern for the environment (Chapman & Sharma, 2001; Fien, Yencken, & Sykes, 2002).

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According to Warner et al. (2010), young people must be given the opportunity to fully engage in social and justice issues confronting their communities, and adults need to provide safe and supportive environments where young people can thrive and be creative. Supportive environments have been found to be instrumental in helping young people gain social skills, build confidence and contribute to their communities (Lerner, Lerner, & Phelps, 2008). Young people's involvement in activities and organisations offer them possibilities to borrow examples, alternatives, values and norms from social practices outside their own families (Jans, 2004).

Some may question whether there is need for environmental education to go beyond just preparing for knowledge to preparing for action. The answer to this question lies in research that suggests that information is not always enough to lead to long-lasting behavioural change (Corraliza & Berenguer, 2000; Culen & Mony, 2003). In a study of ecological knowledge, Armagan and Koksal (2010) found that elementary 7th- and 8th-grade students lacked proper environmental knowledge in spite of living in the city and having various media, such as TV, radio, and newspapers, to obtain information from. These authors suggested that when teaching students about the environment, teachers should place experiences before narration and that concrete examples should be used. In order to design more effective environmental education programs, educators need to gain a better understanding of human behaviour in terms of what motivates people to get involved in social issues that may not affect them directly (Crompton & Kasser, 2009) and find ways to get the best out of youth during their developmental stages.

Theoretical Perspectives

Psychological theories have been applied in different fields to understand human behaviour. One theory that has been used to understand environmental behaviour is the self-determination theory proposed by Deci and Ryan (1985). Self-determination theory states that people feel self-determined when their basic psychological needs such as competence, relatedness and autonomy are satisfied. This theory addresses not only the central questions of why people do what they do, but also the costs and benefits of various ways of socially regulating or promoting behaviour. The self-determination theory arose from research that showed that rewards do not always motivate subsequent persistence in behaviour (Deci, Koestner, & Ryan, 1999). Linking intrinsic motivation and the social contextual effects on it to the basic human needs for competence and autonomy, Ryan and Deci (2000) showed that intrinsic motivation is an inherent human characteristic that could be undermined or enhanced depending on whether the social environment supported or thwarted the need for competence or self-determination. If an event supports the basic needs, it enhances intrinsic motivation, but if it thwarts or threatens the basic needs, intrinsic motivation is undermined. Positive feedback and choice have been reported to enhance experiences of competence and self-motivation (Deci & Ryan, 2012). Self-determination theory research has shown that social contexts and communication styles affect motivation, performance and wellbeing (Deci & Ryan, 2012). The self-determination theory therefore provides a broad framework for exploring human motivation and personality.

Applying the self-determination theory to pro-environmental behaviours, Pelletier (2004) reported that people who have self-determined motivation towards the environment behave more voluntarily and maintain their behaviour in the long term. In the current research, self-determination theory is used as a lens for understanding the relationship between pre-service teachers' environmental knowledge and actions, as well as their perceptions of environmental education in schools. I suggest that environmental

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education that empowers young people by giving them the autonomy to take leadership in developing environmental action projects and to engage in public activism can lead to more sustained self-determined motivation among youth.

Methods

A mixed methods research design (Creswell & Plano, 2011) was used in this study. This methodology offered a comprehensive approach to answering the research questions for this study. Mixed methods provide more detail and personal anecdotes that quantitative methods alone cannot provide (Creswell & Plano, 2011). In this study, an online survey was used to collect quantitative data from a larger pool of pre-service teachers, followed by focus group interviews where fewer pre-service teachers expanded on the responses provided on the survey.

The study participants were solicited from a population of 300 Bachelor of Education pre-service teachers in their 2nd through 4th year at a mid-size university in Ontario, Canada. The study focused on pre-service teachers in order to gain an understanding of their environmental knowledge, their willingness to participate in environmental initiatives and their perceptions about environmental education in schools. The pre-service teachers were invited to participate in an online survey and focus group discussion via an email message. The email message requested pre-service teachers to provide consent to participate in the study before completing an online survey. A total of 84 pre-service teachers participated in the online survey and 15 volunteered to participate in the focus group interviews after they completed the survey. The survey response rate was 28%.

The survey instrument used in this study was adopted from the Young People and the Environment questionnaire (Fien et al., 2002). The survey tool contained 20 items and it was modified to suit the objectives of this study. The questions for both the survey and focus group interviews were classified into the following categories: (1) ecological knowledge and knowledge about the environment; (2) source of environmental knowledge; (3) concern about environmental issues; (4) willingness to take action to help the environment; and (5) beliefs and perceptions about the teaching of environmental education in school. The survey questions included a mixture of demographic, multiple choice, rank order scaling, Likert scale, and comment box questions. For example, the multiple choice questions asked for definitions of environmental concepts; rank order scale questions asked for opinions about environmental issues in Canada, as well as the possible actions pre-service teachers have taken to help the environment; the Likert scale questions asked the participants to rank their sources of environmental information and their level of environmental education; and finally, the participants were asked to write their perceptions about environmental education in the comment boxes. The focus group interview questions mirrored some of the survey questions and they were designed to gather more detailed information about the pre-service teachers' environmental knowledge, perceptions about the environment and their perceptions about environmental education in schools. Three focus group interviews (with five students in each) were facilitated by a research assistant. The interviews were audio recorded and later transcribed verbatim for analysis. Transcriptions from focus group interviews were read and reread to find common themes across the three interview groups. Analysis of survey data involved calculating averages of responses to each of the questions, and further analysis involved graphing and looking at emerging patterns across themes. Although no further statistical analysis was done, methodological triangulation was used to increase the validity of the findings.

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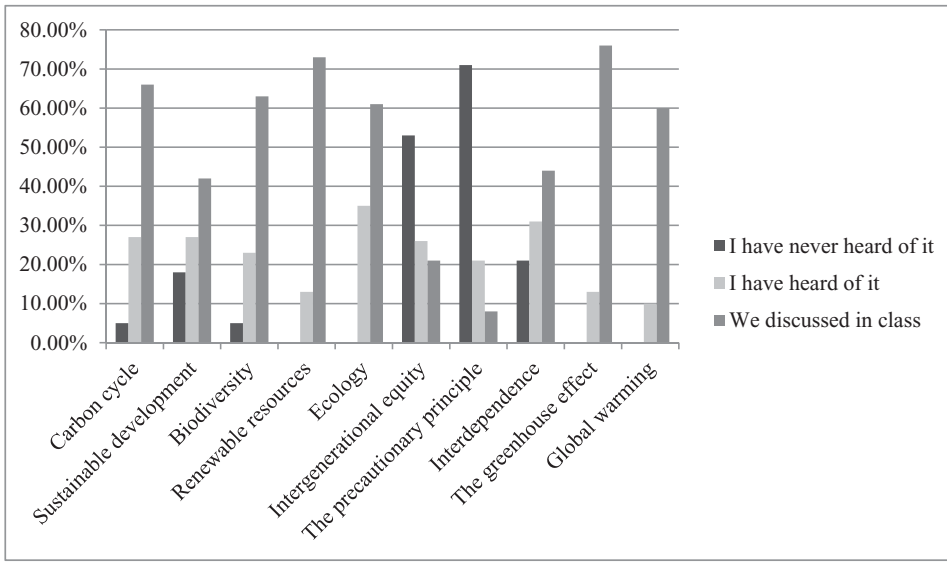

FIGURE 1: Pre-service teachers' familiarity with environmental concepts.

Results

As will be recalled, I embarked on this study to explore pre-service teachers' environmental knowledge, their willingness to participate in environmental initiatives, as well as their perceptions about environmental education in schools. Data from the online surveys and focus group interviews were categorised into the following major themes: (a) pre-service teachers' environmental literacy and its acquisition; (b) pre-service teachers' perceptions about the levels of their environmental knowledge and desire to participate; and (c) pre-service teachers' perceptions about environmental education in schools. A detailed description of each of these themes is provided below, followed by the discussion of results.

Pre-Service Teachers' Environmental Knowledge and its Acquisition

Pre-service teachers in this study demonstrated limited environmental knowledge and ranked their level of environmental knowledge as average. However, the majority of participants were able to define some ecological concepts, such as carbon cycle, biodiversity, renewable resources, ecology, interdependence, the greenhouse effect and global warming. A majority of the participants could not define environmental-specific concepts such as intergenerational equity and the precautionary principle (see Figure 1).

Seventy-four per cent of the pre-service teachers said they had heard about renewable and non-renewable resources, 72% said they had heard about the term 'greenhouse effect' and 60% said they had heard about global warming (Figure 1). The majority of pre-service teachers indicated that they had discussed these concepts in school. On the other hand, 74% of the pre-service teachers indicated that they had never heard about environmental sustainability concepts such as the precautionary principle and 54% had never heard about intergenerational equity (Figure 1). Only a few pre-service teachers said that they had heard about these environmental concepts or discussed them in school.

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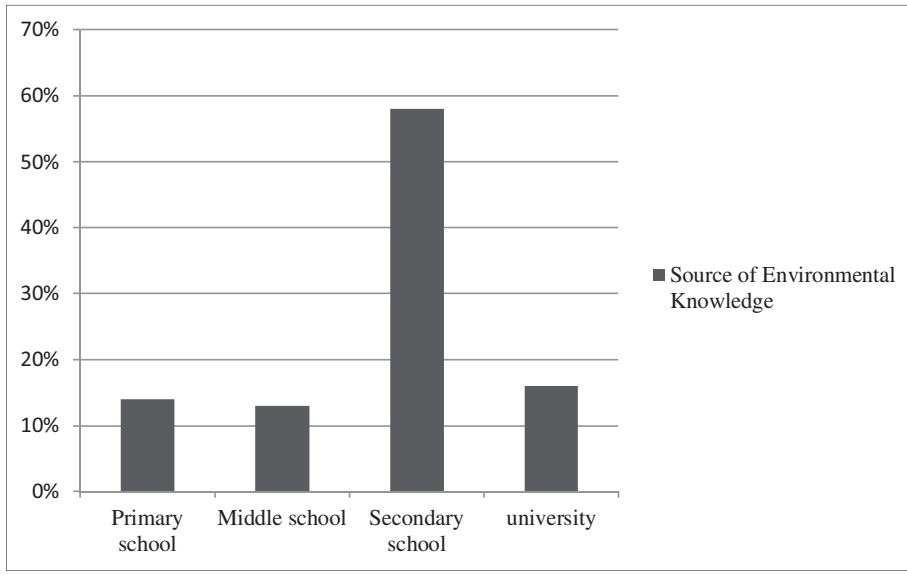

FIGURE 2: Pre-service teachers' source of environmental knowledge.

The majority of pre-service teachers (60%) identified high school as their primary source of environmental knowledge (Figure 2).

However, data from the focus group interviews showed that the pre-service teachers could not recall specific environmental concepts when they were probed to talk about their experiences of learning about environmental content in school. Instead, their recollection of environmental education in school included only the actions they participated in, such as recycling, picking up garbage, and turning off lights on Earth Day. The following quotation from the focus group interview shows one participant's perceptions about her experiences of environmental education in school:

> *I think there could have been more done on sustainability and environmentalism than there was. I remember clean-ups, up until high school doing clean-ups outside but I don't remember a teacher ever talking about environmentalism. (Mary)*

A general discussion among pre-service teachers focused more on the actions they participated in than on the environmental content they learned in school. They seemed to equate environmental knowledge to activism, which could be a reflection of their expectations of environmental education. The qualitative data reveal that the pre-service teachers do not seem to connect the ecological and environmental concepts to the environmental actions they participated in. The qualitative data also show that a few pre-service teachers felt that other sources of information were more influential than school in strengthening their current environmental understanding. The following quotation from the focus group interview shows one participant's perceptions about how she acquired most of the environmental knowledge on her own:

> *I think I figured most of my environmental stuff has come around on my own, my own research. Although sometimes other people influenced it too: my friends, acquaintances, family, but I wouldn't say school had a humungous impact. It*

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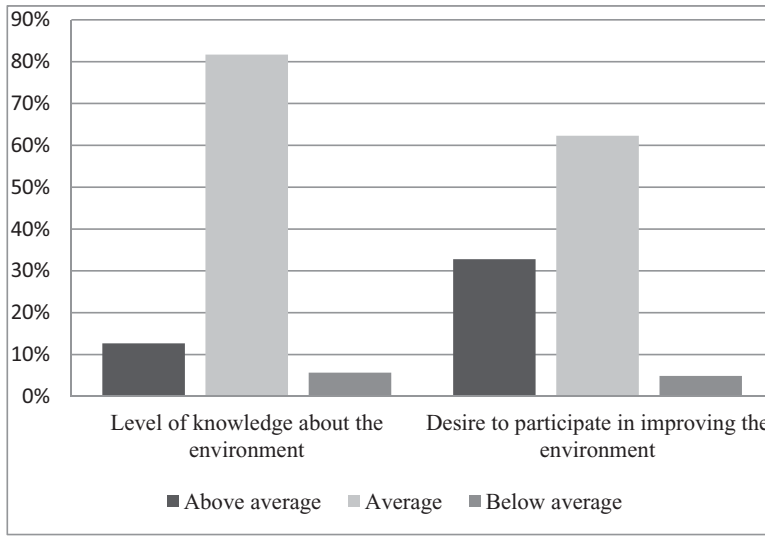

FIGURE 3: Pre-service teachers' level of environmental knowledge and their desire to participate.

> *made me recycle and I still recycle but I don't know if it's done that much for my views on environmentalism and sustainability. (Lyan)*

Again, a closer look at the data from focus group discussions show that the pre-service teachers' understanding of the environment seems to be focused more on activism, a component that they felt was missing from the environmental education they learned in school.

Pre-Service Teachers' Perceptions About Their Levels of Environmental Knowledge and Desire to Participate

The majority of pre-service teachers rated their knowledge about the environment and their desire to participate in environmental initiatives as average (see Figure 3).

Eighty-two per cent of the survey participants rated their level of environmental knowledge as average, with only a minority (12%) rating their knowledge as above average and 5.7% as below average (Figure 3). The results also show that the majority (63%) of the participants rated their desire to participate in actions to improve the environment as average, with 32.8% indicating an above average desire to participate, and only 4.9% indicating below average desire to participate (Figure 3). However, it is important to note that in total, about 90% of the pre-service teachers rated their environmental knowledge as well as their desire to participate in improving the environment as average to above average. Only slightly more than 10% of the pre-service teachers rated their environmental knowledge as above average and more than 30% rated their desire to participate in improving the environment as above average.

Another relationship that emerged from the study was that pre-service teachers who rated their desire to participate in helping the environment as above average had at least tried to take some action or would consider doing so. When asked whether they had taken specific actions such as deciding to reuse and recycle, encouraging someone else to change an activity that is harmful to the environment, or choosing household products that are better for the environment, about half of the respondents said that

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they had taken some action, 42% said they would consider doing so, and only 8% said they would not consider doing so. Sixty per cent of the respondents who had participated in actions to improve the environment either said that they understood the importance of doing so or felt obliged to do so, and 30% either said it saves money or they do so because their family does it.

Data from focus group interviews also highlighted pre-service teachers' views about the important role families play in influencing participation or non-participation in environmental action initiatives, as shown in the following quotations from the focus group interview:

> *I find it really does help to have supportive friends and family members. Uh, for the most part my family has been supportive of my environmental pursuits. But um … you can change their minds I find. (Gina)*

> *I think if a younger participant is saying 'oh Mom we should do this' and the mom is saying 'that's too much work, you do it but I'm not doing it' the child would just brush it off and be like 'ok, well it can't be that important'. (Eileen)*

The pre-service teachers' perceptions highlight their understanding of the important role that adults should play in supporting environmentalism among youth.

Pre-Service Teachers' Perceptions About Environmental Education in Schools

In the focus group interviews, pre-service teachers shared the belief that schools play a significant role in developing pro-environmental behaviours among students, as highlighted in the following quotation from the focus group interview:

> *I think that schools have an impact, even if the students are only acting on being environmentally friendly at school, I think that makes a huge impact because you'll get how many students who are in a school and how big school buildings are, I think that even if the kids go home and do whatever they feel like, as long as they're doing it at school I think it still has an impact so I think schools play a big role in that. (Celia)*

The pre-service teachers felt that it would be easier to engage students in environmental initiatives in school since they are a captive audience at least for the time they are in school. The pre-service teachers also share their belief that if teachers act as environmental activists, they can be role models for their students and that could make a huge impact on motivating students to participate and develop pro-environmental behaviours, as highlighted in the following quotation from the focus group interview:

> *I think you can create change when you're teaching, especially since you have a captive audience of 30 students every day for 6 hours. I think if a teacher is dedicated to environmentalism it really works to work it into the curriculum and work it into our lessons and have a helper in the class to sort the recycling bin and explain why we recycle and really become very active with the environment in the classroom. I think that you're going to create a bunch of mini-environmentalists … if only for the year, maybe but it's going to stick with some of them. And some of them are going to take it home. (Whitney)*

In addition to these sentiments, there was a general concern among the pre-service teachers that there is more talk in school about what needs to be done about the environment and less doing. In the quotation below, one participant clearly highlights the fact that there is no evidence of how schools are taking action to mitigate the environmental crisis:

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> *… my fear is that from a teacher's perspective, we talk in schools about the environment but there's not that much proactive stuff going on to actually do stuff in the community. Um, but I know that some schools are doing it, like Valley View Public School in the Valley. They have a really good … like their whole school is based around like low-flush toilets and they have a green roof and stuff like that. And I think that more schools and more buildings should be leaning towards that. (Barbara)*

The pre-service teachers also shared their belief that teachers can transform their teaching in order to make a difference in the level of environmental participation among youth.

Discussion

Findings from the study revealed three key themes emerging from the study. First, the pre-service teachers in the study demonstrated some knowledge of ecological- and environmental-related concepts but they were not familiar with environmental-specific concepts such as intergenerational equity and the precautionary principle. These findings are in keeping with earlier research. Boubonari et al. (2013), for example, found that Greek primary pre-service teachers had a relatively moderate level of knowledge of marine pollution, while holding some misconceptions. Several researchers have also found that pre-service teachers from different parts of the world have misconceptions on various environmental issues and limited knowledge in some areas (Boubonari et al., 2013; Michail et al., 2007; Pe'er et al., 2007; Spiropoulous et al., 2007; Stir, 2006). Other researchers have also found that prospective teachers have misconceptions regarding complex issues such as the greenhouse effect, ozone layer depletion and acid rain (Boyes et al., 1995; Dove, 1996; Groves & Pugh, 1999; Khalid, 2003).

The limited knowledge about environmental specific concepts among pre-service teachers could be due to lack of specific environmental education in school. The environmental concepts that pre-service teachers in this study were able to define — for example, carbon cycle, sustainable development, biodiversity, renewable resources, ecology and interdependence — are terms that they would have learned in high school biology. These findings could be explained by the fact that although all students in Ontario are required to take some high school biology courses, only one environmental science course is offered in high school and it is not a compulsory subject. Chances are that the majority of participants in this study may not have taken such an environmental specific course. In Ontario, the environment is integrated in the primary and middle school curriculum, but specific environmental concepts are not covered in depth. This could be the reason why the pre-service teachers in this study failed to identify primary school as their source of environmental knowledge. Boubonari et al. (2013) describe a similar situation in Greece with regards to concepts related to marine pollution that are superficially touched on in the primary and secondary education. This idea is supported by well-documented research, which shows incomplete implementation of environmental education in schools in different parts of the world (Holdsworth et al., 2008; Nielsen et al., 2012; Spiropoulou et al., 2007).

Triangulation of the quantitative and qualitative data shows that there was a disconnection between the concepts they learned in school and their perception of environmental knowledge. When the pre-service teachers were probed to talk more about their experiences learning about environmental content in school, none of them mentioned specific environmental concepts they learned in school. In fact, the pre-service teachers showed that they could clearly remember environmental actions they participated in compared to specific environmental concepts taught in school. This finding is

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consistent with literature that calls for the importance of translating environmental theory into practice through integration of environmental action projects into the school curriculum (Gwekwerere, 2011; Matthews & Taylor, 1999; Youniss & Levine, 2009). Failure by the pre-service teachers to relate the environmental concepts to their own understanding of environmental knowledge is indicative of the limitations of teaching environmental content in isolation from real-life context. The actions students remembered are normally done as extra-curricular activities on special days such as Earth Day.

These findings seem to point to the fact that real-life environmental actions seem to have a more lasting impact on students long after they leave school. This is consistent with literature showing that information is not always enough to lead to long-lasting behavioural change (Corraliza & Berenguer, 2000; Culen & Mony, 2003). According to Armagan and Koksal (2010), there is a need to place experiences before narration when teaching students about the environment. Data from this study helps support the possibility of integrating practical examples and actions that students may remember long after they leave school. One suggestion would be to design an environmental education curriculum that has practical environmental actions as the main focus, with relevant environmental concepts such as global warming, climate change and biodiversity embedded within each of the actions.

Second, the findings show that the majority of pre-service teachers in this study rated both their knowledge about the environment and their desire to participate in environmental initiatives as average. These findings are consistent with earlier research that reported limited knowledge about the environment among primary pre-service teachers (Boubonari et al., 2013; Pe'er et al., 2007; Stir, 2006; Tuncer et al., 2009). The findings also support Esa (2010), who reported how lack of environmental knowledge among students and teachers is believed to contribute to lack of pro-environmental behaviours. The findings in this study seem to show a pattern in which average knowledge about the environment results in average desire to participate in environmental initiatives. This assumption is supported by the fact that the few pre-service teachers who rated their environmental knowledge as above average indicated that they had taken some action to help the environment.

The few pre-service teachers who rated their knowledge about the environment as above average are likely to be the ones who mentioned that they learned most of what they know about the environment on their own. These ideas are in keeping with the self-determination theory (Deci & Ryan, 2012). Pelletier (2004) reported that people who have self-determined motivation towards the environment behave more voluntarily and maintain their behaviour in the long term.

The actions taken by the pre-service teachers who participated in the focus group interviews show some level of self-determined motivation that was not shared by all participants. The current findings support earlier research that has revealed the varying levels of care and participation among young people as it concerns the environment and their desires to make a difference (Foutz et al., 2011; Warner et al., 2010).

Third, the pre-service teachers shared their belief that schools and adults play a significant role and that if teachers act as environmental activists, they can make a huge impact on motivating students to develop more pro-environmental behaviours. Pre-service teachers in this study talked about the opportunities that teachers can use to influence students who are in their care for 6 to 8 hours a day. Their ideas are in agreement with Lerner et al. (2008), who highlighted the need for adults to provide safe and supportive environments where young people can thrive and be creative. Such supportive environments can be instrumental in helping young people gain social skills, build confidence and contribute to their communities.

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The pre-service teachers in this study felt that participation in environmental initiatives is essential to empower and motivate students to adopt more sustained pro-environmental choices that would help transform their knowledge to action. Their thinking is in agreement with Warner et al. (2010), who also talked about the need to give young people opportunities to fully engage in social and justice issues confronting their communities. According to Jans (2004), young people's involvement in activities and organisations offer them possibilities to borrow examples, alternatives, values and norms from social practices outside their own families.

Finally, the pre-service teachers in this study expressed their concern about the lack of action compared to the amount of talk about the environment in schools. They felt schools could lead by example to show what could be done about the environment. This observation is in agreement with several studies that have shown how education systems (both schools and higher education) have not fully embraced environmental education, despite the many years of attention to environmental and sustainability issues (Holdsworth et al., 2008; Nielsen et al., 2012). One major reason for this lack of action is that even though schools and universities agree or commit to including environmental and sustainability issues in their curriculum, teachers and academics may not have the necessary support and professional development they need to fully address these issues. As mentioned earlier, Ontario has an environmental education policy that calls for integration of environmental education across the curriculum; however, implementation of the curriculum depends on the teacher's level of competence in the area.

The limitations of this study were that a small sample of pre-service teachers enrolled in the Bachelor of Education program was used and this does not represent all the pre-service teachers in Ontario. There is need for further studies to identify how environmental education is being implemented in the schools and the real reasons for the lack of environmental action despite the knowledge that teachers and students may have.

Conclusion and Further Directions

The pre-service teachers' perceptions about their knowledge and attitudes about the environment, as well as their limited knowledge about environmental specific concepts, is also consistent with previous research that shows that limited environmental knowledge among students and teachers is believed to contribute to lack of pro-environmental behaviours. These findings helped answer some of the questions that led to this study with regards to the limited participation in the EEOC by pre-service teachers. The majority of pre-service teachers indicated that their knowledge about the environment and desire to participate in environmental initiatives was average. These findings seem to point to the fact that the few students who participate in the EEOC have self-determined motivation. This assertion is supported by a quotation from one of the focus group participants, which showed she gained most of the environmental knowledge she has from learning on her own.

The pre-service teachers' perceptions of environmental education in schools are consistent with literature that highlights the need to give young people opportunities to fully engage in environmental issues confronting their communities. These findings point to the necessity for developing environmental education programs that empower young people to develop self-determined motivation. This can be achieved by giving them the autonomy to take leadership in developing environmental action projects and to engage in public activism while they are in school. In order for this to happen, a comprehensive and holistic strategy for environmental education in schools needs to involve: (1) development of an environmental education curriculum that has practical environmental action projects as the main focus with major environmental concepts

integrated within each action project; (2) engaging students in environmental initiatives that go beyond simple practical actions by giving them the opportunity to solve real problems in their communities; and (3) creation of adult-youth partnerships where teachers, parents and other adults acting as role models can nurture young people's creativity and leadership skills. This can lead to more sustained pro-environmental behaviours among students who may become future leaders.

Keywords: environmental education, pre-service teachers, teacher education, perceptions, environmental action, environmental knowledge, participation, pro-environmental behaviour, self-determined motivation

References

Armagan, F.O., & Koksal, E.A. (2010). Factors effecting pre-service teachers' performances on an environment achievement test. *Procedia — Social and Behavioural Sciences, 9*, 1585–1591.

Boubonari, T., Markos, A., & Kevrekidis, T. (2013). Greek pre-service teachers' knowledge, attitudes and environmental behaviour towards marine pollution. *The Journal of Environmental Education*, *44*, 232–251.

Boyes, E., Chambers, W., & Stanisstreet, M. (1995). Trainee primary teachers' ideas about the ozone layer. *Environmental Education Research*, *1*, 133–145.

Chapman, D., & Sharma, K. (2001). Environmental attitudes and behavior of primary and secondary students in Asian cities: An interview strategy for implementing an eco-schools programme. *The Environmentalist*, *21*, 265–272.

Creswell, J.W., & Plano, C. (2011). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications.

Crompton, T., & Kasser, T. (2009). *Meeting environmental challenges: The role of human identity*. Surrey, UK: WWF-UK: Panda House Goldaming.

Corraliza, J., & Berenguer, J. (2000). Environmental values, beliefs and action: A situational approach. *Environment and behaviour, 32*, 832–848.

Culen, G.R., & Mony, P.R.S. (2003). Assessing environmental literacy in a non-formal youth program. *Journal of Environmental Education, 34*, 26–28.

Cutter-Mackenzie, A. (2010). Australian Waste Wise Schools Program: It's past, present and future. *The Journal of Environmental Education*, *41*, 165–321.

Cutter, A., & Smith, R. (2001). Gauging primary school teachers' environmental literacy: An issue of priority. *Asia Pacific Education Review, 2*, 45–60.

Deci, E.L., & Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E.L., & Ryan, R.M. (2012). Self-determination theory. In P.A.M. Van Lange, A.W. Kruglanski, & E.T. Higgins (Eds.), *Handbook of theories of social psychology* (pp. 416–437). London: Sage Publications.

Deci, E.L., Koestner, R., & Ryan, R.M. (1999). A meta-analysis of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627–668.

Dove, J. (1996). Student teacher understanding of the greenhouse effect, ozone layer depletion and acid rain. *Environmental Education Research, 2*, 89–100.

Esa, N. (2010). Environmental knowledge, attitudes and practices of student teachers. *International Research in Geographical and Environmental Education*, *19*, 39–50.

Fien, J., Yencken, D., & Sykes, H. (2002). *Young people and the environment: An Asia Pacific perspective*. Netherlands: Kluwer Academic Publishers.

Foutz, S., Hall, M., Luke, J.J., & Mayhew, M. (2011, April). *A youth directed science café: Impacts on teen pre-service teachers*. Paper presented at the National Association of Research in Science Teaching International Conference, Orlando, FL.

Groves, F.H., & Pugh, A.F. (1999). Elementary pre-service teacher perceptions of the greenhouse effect. *Journal of Science Education and Technology*, *8*, 75–81.

Gwekwerere, Y. (2011). Meeting environmental sustainability challenges: Strategies for increasing environmental awareness and nurturing pro-environmental behaviour among youth. *Interactions: The Ontario Journal of Environmental Education, 24*, 34–35.

Hart, R.A. (2008). Stepping back from 'the ladder': Reflections on a model of participatory work with children. In A. Reid, B.B. Jensen, J. Nickel, & V. Simovska (Eds.), *Participation and learning: Perspectives on education and the environment, health and sustainability* (pp. 19–31). New York: Springer.

Holdsworth, S., Wyborn, C., Bekessy, S. & Thomas, I. (2008). Professional development for education for sustainability: How advanced are Australian universities? *International Journal of Sustainability in Higher education*, *9*, 131–146.

Hsu, S.J., & Roth, R. (1998). An assessment of environmental literacy and analysis of predictors of responsible environmental behavior held by secondary teachers in the Hualien area of Taiwan. *Environmental Education Research*, *4*, 229–249.

Jans, M. (2004). Children as citizens: Towards a contemporary notion of child participation. *Childhood*, *11*, 27–44.

Khalid, T. (2003). Pre-service high school teachers' perceptions of three environmental phenomena. *Environmental Education Research*, *9*, 35–50.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lerner, R.M., Lerner, J.V., & Phelps, E. (2008). *The positive development of youth: Report of the findings from the first four years of 4-H study of positive youth development 2002–2006*. Medford, MA: Tufts University, Retrieved from http://ase.tufts.edu/iaryd/documents/4HStudyAnnualReport2008.pdf

McKeown, R., & Hopkins, C. (2002). Weaving sustainability into pre-service teacher education programs. In W.F. Filho (Ed.), *Teaching sustainability at universities: Towards curriculum greening* (pp. 251–274). Frankfurt: Peter Lang.

Madruga, K., & da Silveira, C.F. B. (2003). Can teenagers educate children concerning environmental issues? *Journal of Cleaner Production, 11*, 519–525.

Matthews, H., & Taylor, M.L.M. (1999). Young people's participation and representation in society. *Geoform, 30*, 135–144.

Michail, S., Stamou, A.G., & Stamou, G.P. (2007). Greek primary teachers' understanding of current environmental issues: An exploration of their environmental knowledge and images of nature. *Science Education, 91*, 244–259.

National Environmental Education Advisory Council. (2005). *Setting the standard, measuring results, celebrating success: A report to Congress on the status of environmental education in the United States*. Washington, DC: Author.

Nielsen, W., Anderson, P., Hurley, A., Sabljak, V., Petereit, A., Hoskin, V., & Hoban, G. (2012). Preparing action competent environmental educators: How hard could it be? *Australian Journal of Environmental Education*, *28*, 92–107.

Orr, D.W. (2004). *Earth in mind: On education, environment and the human prospect*. Washington, DC: First Island Press.

Pe'er, S., Goldman, D., & Yavetz, B. (2007). Environmental literacy in teacher training: Attitudes, knowledge, and environmental behavior of beginning students. *The Journal of Environmental Education*, *39*, 45–59.

Pelletier, L. (2004). A motivational analysis of self-determination for pro-environmental behaviours. In R. Ryan & E. Deci (Eds.), *Handbook of self-determination research* (pp. 205–232). Rochester, NY: University of Rochester Press.

Rickison, M. (2001). Learners and learning in environmental education: A critical review of the evidence. *Environmental Education Research*, *7*, 207–320.

Rickison, M., Landholm, C., & Hopwood, N. (2009). *Environmental learning: Insights from research into student experience*. Dordrecht, The Netherlands: Springer.

Reid, A., Jensen, B.B., Nickel, J., & Simovska, V. (2008). Participation and learning: developing perspectives on education and the environment, health and sustainability. In A. Reid, B.B. Jensen, J. Nickel, & V. Simovska (Eds.), *Participation and learning: Perspectives on education and the environment, health and sustainability* (pp. 1–18). New York: Springer.

Reid, A. & Nickel, J. (2008). Differentiating the evaluation and conceptions and examples of participation in environmental-related learning. In A. Reid, B.B. Jensen, J. Nickel, and V. Simovska (Eds.), *Participation and learning: Perspectives on education and the environment, health and sustainability* (pp. 32–60). New York: Springer.

Ryan, R.M., & Deci, E.L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development and well- being. *American Psychologist*, *55*, 68–78.

Spiropoulou, D., Antonakaki, T., Kontaxakaki, S., & Bouras, S. (2007). Primary teachers' literacy and attitudes on education for sustainable development. *Journal of Science Education and Technology, 16*, 443–450.

Salter, Z., Venville, G., & Longnecker, N. (2011). An Australian story: School sustainability education in the lucky country. *Australian Journal of Environmental Education*, *27*, 149–159.

Stir, J. (2006). Restructuring teacher education for sustainability: Student involvement through a strengths model. *Journal of Cleaner Production*, *14*, 830–836.

Tuncer, G., Tekkaya, C., Sungur, S., Cakiroglu, J., Ertepinar, H., & Kaplowitz, M. (2009). Assessing pre-service teachers' environmental literacy in Turkey as a means to develop teacher education programs. *International Journal of Educational Development*, *29*, 426–436.

UNESCO. (1997). *Educating for a sustainable future: A transdisciplinary vision for concerned action* (UNESCO publication no. EPD-97/Conf.401/CLD.1). Paris: Author.

Warner, A., Langlois, M., & Dumond, C. (2010). Voices from youth action teams: Creating successful partnerships for community action. In W. Linds, L. Goulet, & A. Sammel (Eds.), *Emancipatory practices: Adult / Youth engagement for social and environmental justice* (pp. 95–108). Boston, MA: Sense Publishers.

World Commission on Environmental Development. (1987). *Our common future*. Oxford, UK: Oxford University Press.

Yavetz, B., Goldman, D., & Pe'er, S. (2014). How do pre-service teachers perceive 'environment' and its relevance to their area of teaching? *Environmental Education Research*, *20*, 354–371.

Youniss, J., & Levine, P. (2009). *Engaging young people in civic life*. Nashville: Vanderbilt University Press.

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