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An international study of high school teachers' experience of incorporating water resources in their teaching

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This qualitative study aims at investigating the significant personal and contextual factors influencing teachers' motivations for incorporating water resources in their teaching. By exploring teachers' experiences teaching water resources in their Education for Sustainable Development (ESD) classroom, this study attempts to close the research gap on the paucity of research on teachers' motivation in teaching water resources within the realm of ESD. Based on the purpose of the study and the social cognitive career theory, this study is guided by two research questions: (1) How do teachers describe their experience of incorporating water resources in their classrooms? (2) Why are teachers motivated to incorporate water resources in their teaching? Ten high school teachers from five countries and regions, Canada, Australia, New Zealand, Taiwan and Hong Kong, who had incorporated water resources into their teaching, were recruited. The researchers adopted Interpretative Phenomenological Analysis with semi-structured interviews and focus group discussions to collect in-depth data to explore their teaching experiences. The results indicated that personal beliefs and characteristics of the community played significant roles in their experiences and motivations. This study's findings can provide insights into how and why teachers' personal beliefs and contextual variables like geographic and cultural influences can encourage teachers to implement water resource elements in their teaching, thereby illuminating the possible responsive pedagogies for successful cross-disciplinary ESD in future.

KEYWORDS

education for sustainable development, interpretative phenomenological analysis, social cognitive career theory, sustainable development goals, teacher's professional development

1. Introduction

COVID-19 has drastically affected the progress of attaining the sustainable development goals (SDGs) in 2030 (UN, 2021). Clean Water and Sanitation, as one of the SDGs, has been brought under the limelight as such issue has become critical to containing the spread of COVID-19 and other diseases (Neal, 2020; UN, 2021;

Valenzuela-Morales et al., 2022). It is believed that education for sustainable development (ESD) is a transformative education that leads to a more sustainable and equitable future society, whereby our current and future generations are equipped with relevant content knowledge and skills like system thinking, problem-solving, critical thinking, negotiation, discussion and collaboration (UNESCO, 2005, 2017). Such skills and knowledge can increase their awareness of local and global issues of sustainable development and foster positive changes in beliefs, values, and attitudes. For example, students are hoped to reflect on their water footprint, raise sanitation and hygiene standards, plan, and evaluate the activities contributing to an increase in water quality and safety locally and globally.

Despite the good intentions and learning goal attainment in incorporating water resources in ESD, such implementation is not as successful as it seems. Although scholars (Andersson et al., 2013; García-González et al., 2020) suggested there are some improvements in in-service and pre-service teachers' knowledge and development of teaching practices in sustainability, some scholars (Summers et al., 2005; Jóhannesson et al., 2011; Eli et al., 2020) also expressed worries on their motivation in incorporating sustainability topics which are beyond the knowledge of nature and science, especially in the teachers' willingness in bringing in attitude or value changes in sustainability. Such reluctance also hampers the chance of bringing topics like water resources into classrooms and the learners' motivation to explore such topics (Jetly and Singh, 2019). Likewise, if teachers are motivated to implement sustainability-related topics in their classrooms, students are more likely to reflect their beliefs, values and attitudes and take action to implement changes (Summers et al., 2005; Kwee, 2021). Middlestadt et al. (2001) further highlighted the impact of education on water conservation behaviors is far more effectively than media coverage or propaganda. To equip our future generation to become the necessary human resources assets to attain the SDGs, it is pressing to think of ways to boost teachers' motivation in various disciplines to incorporate such elements in their teaching.

1.1. Purpose of the study and research questions

This study aims at investigating the significant factors influencing teachers' motivations for incorporating water resources in their teaching. By exploring teachers' experiences of teaching water resources in their ESD classroom, this study has identified the significant personal and contextual factors influencing teachers' motivation, thereby closing the research gap on the paucity of research on teachers' motivation in teaching water resources within the realm of ESD (Lent et al., 1994; Brown and Lent, 2019). Based on the purpose of the study, this study is guided by two research questions:

- How do teachers describe their experience of incorporating water resources in their classrooms?
- Why are teachers motivated to incorporate water resources in their teaching?

2. Literature review

Currently, research studies (Middlestadt et al., 2001; Williams et al., 2009; Valenzuela-Morales et al., 2022) on water education have been focused on the impacts of water education, educational tools, constraints in implementation. First, some scholars (Williams et al., 2009; Lu and Liu, 2015) endeavored to evaluate the effectiveness of educational tools and water education in bringing in such changes. For example, Lu and Liu (2015) also probed into how augmented reality technology can be used to enhance children's learning in marine education. Similarly, Williams et al. (2009) also permitted a gaze into the educational tools leading to a better understanding of social policies alongside individual and collective decisions on water resources. By introducing a simulation model in water resources in a semi-arid region, students enjoyed the first-hand experience of the complicated picture of water usage and conservation, thereby laying a solid foundation of relevant hydraulic literacy to facilitate future decision-making (Williams et al., 2009).

Second, the current studies (Middlestadt et al., 2001; Larson and Redman, 2014; Gizaw et al., 2019; Iwasaki, 2022; Valenzuela-Morales et al., 2022) also identified the positive impact of water education in bringing in changes in attitudes and behaviors within the realm of ESD. For example, scholars (Middlestadt et al., 2001; Iwasaki, 2022; Valenzuela-Morales et al., 2022) studied water conservation education in Japan, Jordan and Mexico, alongside its impact on students' knowledge, beliefs and behaviors, suggesting education can bring in intervention and lead to a change in household water consumption behaviors and persuasion of family members in water conservation. In another study on water, sanitation and hygiene (WASH) education in Ethiopia, Gizaw et al. (2019) affirmed the positive impact of education on behavioral changes. The study accentuated how such behavioral changes lead to greater well-being among children. The WASH education oriented and encourage the implementation of home water treatment in the participants' families, thereby lessening the chances of parasitic infections (Gizaw et al., 2019). Larson and Redman (2014) offered insights into some criteria of successful water education, such as individual learners' subjective understanding and beliefs of social norms and their desirability of actions and outcomes. The researchers suggested instead of forced instalment of declarative knowledge in landscaping and water use in lessons. Empowerment is a more effective means to initiate transformation, whereby social learning and self-realization take a pivotal role in raising their efficacy and leading to actions (Larson and Redman, 2014).

It is evident that water education brought myriad benefits to individuals and communities; however, there were some difficulties during such implementation. First, teachers may not wish to incorporate such a topic in their classrooms. Ruiz-Garzón et al. (2021) analyzed student teachers' perception of water resources and concluded that teachers realized people's unsustainable habits could negatively impact water resources and raised there is a need for raising social awareness. In other studies, scholars (Berglund and Gericke, 2016; Sinakou et al., 2019; Eli et al., 2020) suggested that teachers generally lack interest in implementing sustainability topics like water resources in their classrooms if these are not explicitly needed in their disciplines. For instance, Berglund and Gericke (2016) and Sinakou et al. (2019) also suggested teachers in disciplines apart from science or geography believe that such sustainability issues are not quite related to their subjects and beyond their expertise, thereby tending to disregard such dimensions in their teaching. However, ESD adopts a transdisciplinary approach which requires the effort of teachers from different disciplines to contribute to students' learning (Biasutti et al., 2018; Eli et al., 2020). Water resources are not merely scientific facts but also include social or ethical issues which need students to evaluate, make a judgement and devise a solution (Summers et al., 2005). Teachers' reluctance to implement such topics in their humanities or language classrooms can inhibit students' development of skills and languages for the transformation and reflection of their values and behaviors, let alone their sustainability competencies (Brundiers et al., 2010; Wiek et al., 2011).

In order to combat such unfavorable learning and teaching climate, it is essential to explore how to motivate teachers from various disciplines to incorporate water resources in their teaching, and how such motivation turned into their agentic choices in curriculum design, material selection and lesson planning (Biesta, 2015; Brown and Lent, 2019). However, there is a paucity of studies examining how teachers in various disciplines develop their motivations in incorporating water resources in their lessons. As stated in Biesta (2015, 2017), teachers' democratic professionalism is essential in interpreting the curriculum, wherein engagement with the subject content, tradition and the teacher as a person is necessary. Therefore, examining their motivation in relation to the personal and contextual factors contributing to their motivations and decisions of incorporating water resources can shed light on how to bring more teachers to water resources education and the subsequent success in teaching and learning (Watt and Richardson, 2007; Deci and Ryan, 2008).

3. Theoretical framework: Social cognitive career theory

The social cognitive career theory (SCCT) is selected as the theoretical framework of this study for four reasons.

First, based on Bandura's social cognitive theory (Bandura, 1986), the SCCT is specifically designed to explore the

development of career actions from an individual's motivations by underscoring the reciprocal relationship between self-efficacy, outcome expectation and performance goal attainment (Lent et al., 1994; Brown and Lent, 2019). Richardson and Watt (2010) suggested that self-efficacy is a future direction of teachers' motivation studies. Teachers' self-efficacy plays an important role in their motivation, whereby they perceive positively towards their profession, which yields greater commitment and better teaching outcomes (Ketelaar et al., 2012). By understanding how their self-efficacy and commitment to the incorporation of water resources develops, the goals of ESD in bringing in students' reflections and changes in students' water-related behaviors and attitudes can be achieved.

Second, the SCCT considers individuals as active agencies with capabilities to create changes amid challenges; therefore, individuals with higher self-efficacy are more willing to take on difficult tasks and persist in their actions (Bandura, 1986; Lent et al., 1994). Since previous research (Summers et al., 2005; Kwee, 2021) suggested teachers who have higher motivations bring greater impact on the attainment of competencies and behavioral changes, the application of the SCCT in this study can capture on how teachers' past experiences allowed them to make changes in themselves and brings changes among their students.

Third, the sources of efficacy can be useful information for the schools, professional development institutions to develop programs in strengthening the teachers' motivations in the incorporation of water resources in teaching in various disciplines. According to Bandura (1986), self-efficacy can be achieved from how it is derived from: (a) self-experience; (b) vicarious learning; (c) verbal persuasion, and (d) physiological and psychological states. By exploring how teachers' self-efficacy develops in relation to their teaching goals, the researchers in this study can discover the sources of self-efficacy and identify specific personal and contextual supports and barriers influencing the teachers' decision to incorporate water resources elements in their teaching (Kuebel, 2019; Matusovich et al., 2020).

Fourth, the SCCT scaffolds the mental representation of how teachers are motivated in the flux of their teaching experiences (Lent et al., 1994; Brown and Lent, 2019). With the SCCT constructs, the researchers can reveal how teachers' personal beliefs and past experiences develop their career interest in incorporating water resources into their teaching and how they put effort into classroom management, teaching pedagogies and course material selection and preparation to attain their desired teaching outcomes. It allows the researchers to identify how each individual personal and contextual factor impacts the teachers' motivations, decisions and actions in incorporating water resources in teaching (Lent et al., 1994; Brown and Lent, 2019). On the other hand, the researchers can also gain insights into how their motivation to incorporate water resources in their ESD classroom develops and persists holistically by focusing on the interrelationship between the variables (Lent et al., 1994; Brown and Lent, 2019).

4. Methodology

4.1. Research design

The researchers have selected a qualitative study design to examine teachers' motivation to incorporate water resources in their teaching, whereby these teachers' self-efficacy, outcome expectation and performance goals were considered. Qualitative research studies intend to understand a specific issue through an in-depth analysis of the participants' lived stories, background experiences, and their sense-making process (Seidman, 2011; Larkin et al., 2019). By adopting a qualitative study design, the researchers can examine teacher motivation in relation to their experience of incorporating the water resources component in their teaching career. In order to unfold the teachers' mental representation of making such a decision, the researchers adopted interpretative phenomenological analysis (IPA) is selected as the methodology of this study (Smith et al., 2021). IPA values the individual's lived experiences and their undistorted voices by describing and interpreting the meaning of their lived experiences. The dialogue between the researchers and the participants not only pertains to an in-depth understanding of their sense-making process and lifeworld without distortion, but also provides rich and in-depth data on how their personal beliefs, contextual supports and barriers influence their self-efficacy, outcome expectations and performance goal attainments (Alase, 2017; Smith et al., 2021).

4.2. Participants

Following the IPA handbook (Smith et al., 2021) as a guide, the researchers selected ten in-service teachers as the participants of this study through purposive sampling, whereby the smaller homogenous sample size between 3 and 12 allows a more in-depth description of the teachers' lived experiences and in-depth interpretation of the meaning within their experiences (Dos Santos, 2019a, 2019b). The participants were recruited *via* district networks and language and culture exchange channels. Since ESD requires a holistic framework and an interdisciplinary approach which requires collective effort from teachers with various expertise (Fien and Maclean, 2000; Biasutti et al., 2018), it is important to investigate how motivation develops among teachers from various disciplines and how they incorporate such water resources elements in their curriculum and lesson design. Particularly, previous studies (Eli et al., 2020; Yilmaz Findik et al., 2021) suggested language and humanities teachers were generally less motivated to implement ESD. Therefore, ten teachers teaching various subjects were selected as the participants of the studies. Apart from STEM subjects, participants teaching languages and literature were also included. Table 1 outlines their detailed demography. The participants in this study need to meet the following criteria:

- Completed the initial teacher training
- Currently teaching in one of the government, subsidized or private high schools
- Have incorporated water resources in at least one of their teaching modules in the current and previous school years

4.3. Data collection

The primary data sources of this study are semi-structured interviews and focus group discussions. The researchers conducted two online one-on-one semi-structured interviews with the ten participants (Seidman, 2013). Semi-structured interviews were appropriate as the researchers could ask open-ended questions and follow-up questions in relation to the SCCT constructs and the interviewees' interests and concerns (Lent et al., 1994; Alase, 2017; Brown and Lent, 2019; Smith et al., 2021). Each interview lasted from 46 to 108 min and contributed to 72–98 pages of written transcripts. The first interview focused on the teachers' personal background, like personal beliefs, education background and previous teaching experience. The second interview focused on their current experiences of incorporating water resources into their teaching, whereby the researchers probed into their challenges, actions and motivations. The researchers also invited the participants to share their recorded lessons, teaching materials and students' work as supporting evidence to the data collected from the interviews and focus group meetings to add credibility and trustworthiness to this study. However, owing to the agreement with the participants and careful consideration of copyright issues and the protection of the personal privacy of adolescent students, the recorded lessons, teaching materials and students' work were only used in the triangulation process but not in any forms of publications (Creswell, 2012).

4.4. Data analysis

All interviews were recorded on a separate electronic device and transcribed verbatim. Later member-checking was employed by sending the transcripts back to the participants for feedback and approval to enhance the credibility of this study (Creswell, 2012). The researcher adopted a general inductive approach in data analysis, following the suggestions by qualitative researchers (Shaw et al., 2016; Alase, 2017; Birtwistle et al., 2021; Smith et al., 2021) that large chunks of data have to be narrowed down to meaningful themes and subthemes. The researchers began the data analysis by first reading the transcripts a few times to get the gists (Creswell, 2012; Alase, 2017). Open coding and axial coding techniques were employed to reduce the chunk of data to themes and sub-themes. Due to the massive number of themes and sub-themes, it leads to difficulty in standard reporting. Therefore, the researcher applied axial coding to narrow the themes and subthemes to less than 10

TABLE 1 Demography of the participants.

Name	Gender	Country of origin	Age	Subject taught	Years of experience	Campus location
Ian	M	Canada	Early 30s	History	5	Canada
Lora	F	Canada	Late 20s	Chinese as Second Language	2	Canada
Matilda	F	Australia	Mid-30s	English, English as an Additional Language/Dialect	8	Australia
Sam	F	China	Mid-30s	Chinese and Literature, Chinese (Continuer), Chinese (Beginner)	6	Australia
Karen	F	New Zealand	Early 40s	Science, Mathematics	10+	New Zealand
Jason	M	New Zealand	Late 40s	English as Second Language	10+	New Zealand
Anson	M	Taiwan	Mid-20s	Geography	2	Taiwan
Anita	F	Taiwan	Mid 40s	Chinese Language, Chinese Language and Literature	10+	Taiwan
Joyce	F	Hong Kong	Early-40s	Mathematics, Information and Communication Technology	10+	Hong Kong
Jeremy	M	Hong Kong	Mid-50s	Chinese Language, Chinese Literature	10+	Hong Kong

for readability and reporting (Patton, 2002; Merriam, 2009). After the axial coding, two themes and four subthemes emerged.

4.5. Human subject protection

The researchers acknowledged the importance of confidentiality and endeavored to protect the participants' personal information (Merriam, 2009; Creswell, 2012). First, all the participants gave their informed consent before the study embarked. Second, each participant is assigned a pseudonym. All the recognizable personal information was masked so as to protect the participants from their current and future employers (Merriam, 2009; Creswell, 2012). Third, all the filled and unfilled consent forms, personal contacts, audio recordings, transcripts and other related materials are locked in a password-protected electronic device with the sole assets of the researchers (Alase, 2017; Smith et al., 2021). Upon the completion of the project, the researchers destroyed and deleted all the related materials. Thus, this study was conducted in accordance with the Declaration of Helsinki with approach protocols.

5. Findings and discussion

Although the participants were from different parts of the global communities, many shared similar stories and experiences

with the researchers. Based on the theoretical framework, research questions, and the aims of the study, the researchers could categorize a series of meaningful groups and themes. Figure 1 presents the thought process of relating the keywords, themes and subthemes to the theoretical framework Social Cognitive Career Theory (Lent et al, 1994; Brown and Lent, 2019). In order to outline the findings with the discussion of the literature review, the researchers combined the findings and discussion chapters as a comprehensive chapter for immediate comparison. Table 2 outlines the themes and subthemes from the findings. Table 3 presents the keywords in relation to the themes and subthemes and their respective appearances in the participants' quotes.

5.1. Personal beliefs

Scholars (Gagné and Deci, 2005; Deci and Ryan, 2008) suggested that personal beliefs contribute to teachers' development of aspirations and life goals, thereby inducing an empowering effect on teachers' motivation and energization in their actions in their careers. Unlike previous studies (Summers et al., 2005; Agirreazkuenaga, 2019; Eli et al., 2020) indicating a negative correlation between teachers' personal belief in ESD and their decision to implement sustainable development factors in their teaching, this study showed that teachers are more motivated in ESD and more willing to incorporate water resources component in their teaching due to their

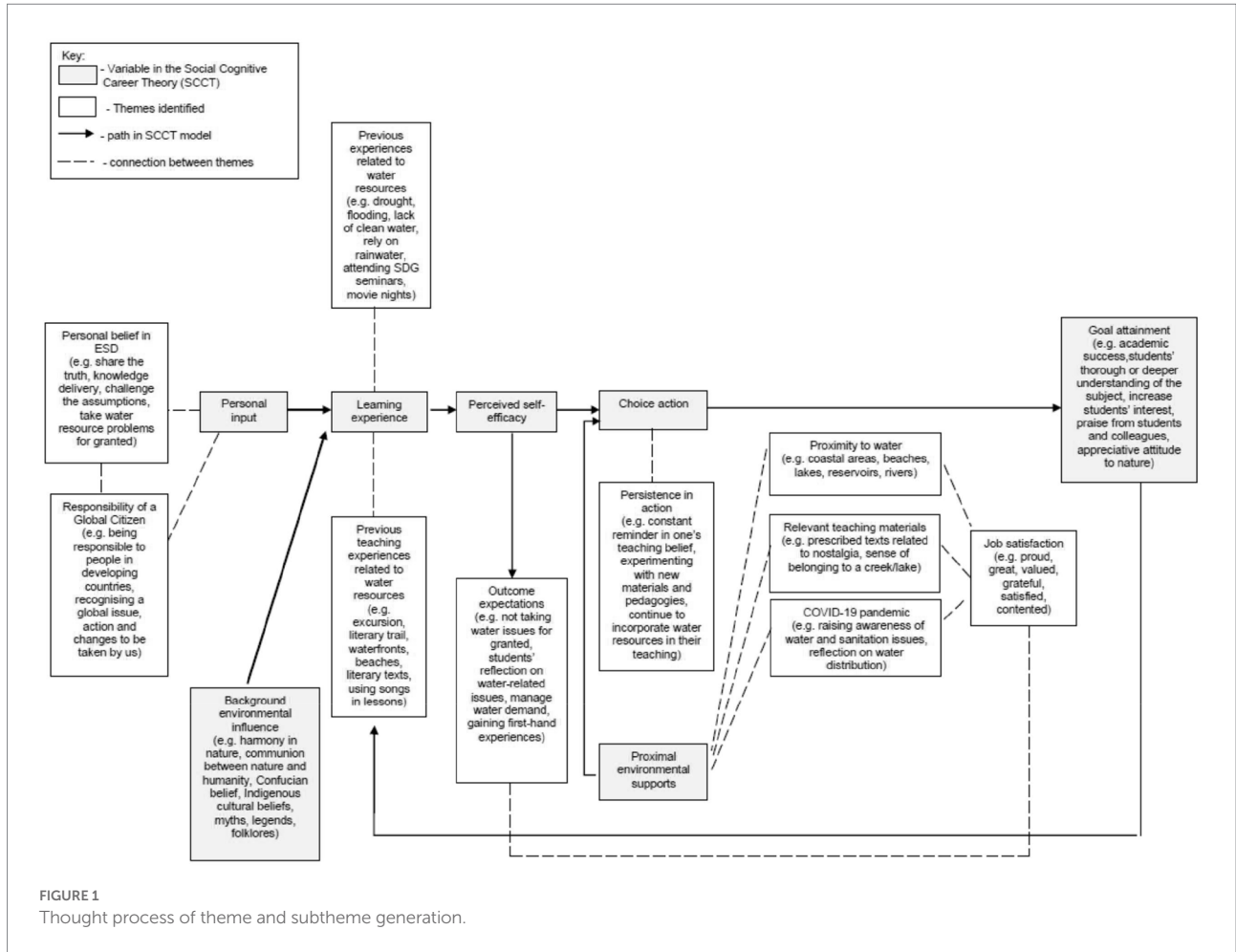


FIGURE 1 Thought process of theme and subtheme generation.

TABLE 2 Themes and subthemes.

Themes and subthemes		
4.1	Personal Beliefs	
	4.1.1	Desire to Share Their Experience
	4.1.2	Responsibility of a Global Citizen
4.2	Characteristics of the Community	
	4.2.1	Geographic Location
	4.2.2	Cultural Influence

personal beliefs on water resources management, which can be seen from their desire to share their experiences on water-related issues and the sense of civic responsibility.

5.1.1. Desire to share their experience

This study showed that teachers' previous experiences positively influence their motivation to incorporate water resources in their ESD teaching. Precisely, teachers' upbringing greatly shapes their personal beliefs on the necessity of preserving clean water. Combined with their passion for teaching and

teaching belief, it forms their background experiences to motivate their incorporation of water resources elements in their teaching (Lent et al., 1994; Brown and Lent, 2019). The participants said,

...My family came from Indonesia... There are lots of earthquakes... We were cut off from fresh water for more than a week... Students got fresh water supply everywhere... They just need to refill their water bottle in the playground or grab a bottled water from the tuck shop. They take for granted that not everyone in the world can have access to clean and fresh water. As a teacher, it's my mission to let them know that... (Joyce, Hong Kong, first interview)

... Scarcity of clean water also happens in developed countries... happens in regions with ample rainfall ... I used to live in Taree [a town in regional New South Wales, Australia]. Almost every year, there is flooding ... Manning River, you know ... Many people think flooding means you have lots of water. They [My students] don't know floodwater actually contains heaps of debris and contaminates our clean water source. That's the truth I wanna tell them ... (Sam, Australia, first interview)

TABLE 3 Keyword chart of the themes and subthemes.

Theme	Subtheme	Keyword	Frequency	
Personal beliefs	Desire to share their experience	Mission/commitment	12	
		Want to/wanna tell/share	34	
		Truth	12	
		Clean water supplies/sanitation	14	
		Drought/flooding/water crisis	20	
		Child/childhood/grow up/upbringing	35	
		Felt great/satisfied	15	
		Take for granted/assume/assumption	8	
	Responsibility of a global citizen	Responsibility of a global citizen	Reflect	12
			Responsible/responsibility	25
			Understand	17
			Empathy	4
			Think about	14
			Not a particular country	12
			Global/world/globe	20
			Do together	17
			Water demand/water conservation	10
Sanitation			6	
Characteristics of the community	Geographic location	Developing/developed countries	25	
		We/ourselves/us	50	
		Action/can do/to do/should do	78	
		Change	20	
		Beaches/waterfront/shoreline/shore	45	
		Rivers/streams/creeks	16	
		Catchment	13	
		Lakes/reservoirs	20	
		Properties/characteristics	18	
		Literature	17	
		Journey/leisure/walk	14	
		Outdoor activities/excursions/fieldtrips	20	
		First-hand experiences	12	
Cultural influences	Cultural influences	Gain/master knowledge	30	
		Traditional thoughts/beliefs	32	
		Unity/communion/ harmony with nature	32	
		Humanity	18	
		National identity	8	
		Culture	40	
		Myths/legends/folklores	30	
		Songs	10	
	Appreciative attitude/appreciation to nature	11		

Previous studies (Summers et al., 2005; Agirreazkuenaga, 2019; Eli et al., 2020) suggested that teachers' motivation for incorporating sustainability topics in their teaching is generally

low, as reflected in their personal belief that such issues are not directly relevant to their subjects. However, this study showed that teachers who have previously faced water-related issues such as

water treatment or water scarcity are more motivated to incorporate water resource components in their lessons and encourage their students to water-saving actions (Brown and Lent, 2019; Iwasaki, 2022). Their motivation can be reflected in their urgency to share their first-hand experiences with their students and deliver such knowledge to their students so as to their awareness of the issue. Another two participants said,

... I always asked myself what I could do to make them [my students] aware of the water issue. I believe that's stories, not facts. I shared my story in class—in the first year of teaching in regional WA [Western Australia], I had to collect and drink rainwater ... It sounds absurd to my students. But I want to bring this message to my students; even in developed countries, not all of us can access water treatment facilities or storage... (Matilda, Australia, first interview)

... We never notice water is a precious resource until there is a drought. We always think Taiwan is a subtropical area... A lot of rain there... Now we are facing the worst drought. Reservoirs are at a minimal capacity. The water levels are alarming. We have to prepare for the worst. That's what I wanna tell my students... I felt great coz I did that... (Anita, Taiwan, first interview)

Most of the participants in this study felt strongly that they have such a commitment to share their previous experiences to challenge the assumption of the abundance of water resources. They believe that by sharing their first-hand experiences, their students can permit a gaze into the social issues related to water resources. By allowing the students to examine the sustainability issues across different scales, specifically from local and global and across different domains like environment and economy, the teachers developed strong positive affection for empowering their students with the systems-thinking competency (Brundiens et al., 2010; Wiek et al., 2011). This study found that such personal belief acts as a source of self-efficacy to induce their stronger desire to incorporate water resources component into teaching, thereby achieving the learning outcome of ESD: examining and reflecting on their own beliefs critically (Birdsall, 2010; Sinakou et al., 2019). Another participant, Jeremy, affirmed and echoed such a view:

... People like stories... When I was young, there was a water crisis. There was a water supply every four days for four hours. We had to fill our buckets from the street taps. Through this first-person sharing, they remembered the story ... I asked them [my students] themselves where the freshwater comes from ... They remembered fresh water is a precious natural resource. I feel happy about that. I will also use this story as a lead-in in future... (Jeremy, Hong Kong, second interview)

When teachers are able to attain both the learning contents and outcomes of ESD (UNESCO, 2005, 2017) by raising their

students' awareness on topics like universal access to safe drinking water, the satisfaction and sense of achievement gained in the successful teaching serve as an extra source of self-efficacy to encourage teachers to adopt similar teaching in future (Lent et al., 1994; Lent and Brown, 1996; Brown and Lent, 2019). According to the SCCT, such postulation boosts their self-efficacy and motivation to incorporate water resources in their future teaching (Lent et al., 1994; Lent and Brown, 1996; Brown and Lent, 2019).

5.1.2. Responsibility of a global citizen

This study shows that teachers with a greater sense of responsibility as a global citizen are more likely to have greater motivation to incorporate water resources into their teaching. Two of the participants said,

... I joined a movie night about the United Nations' Sustainable Development Goals... It's an intergenerational and international issue. Think about the countries around [New Zealand]. Less than half of them got integrated water resources management. I wish to let my students know that it's not an issue of a particular country. Everyone is responsible for that... not just our country ... (Karen, New Zealand, first interview)

... I joined a seminar when I was in uni [university] ... kind of entrepreneurship and start-up seminar ... I got a chance to talk with scientists, scholars, politicians and environmental activists. Then they showed me a handy tool to purify water. For us, it might be just for camping. For people in Africa, it could be lifesaving. I hope my students can also engage with and show respect to people living far from them ... understand how difficult their life can be. Think about who we are and what we can do. It's not just I tell them what to do ... (Joyce, Hong Kong, first interview)

Previous studies (Brigham, 2011; Miedema and Bertram-Troost, 2015) suggested global citizenship encourages an individual to take an active role, exercise critical thinking and bring awareness to the interconnectedness between humanity and the environment so as to attain social equity and justice. This study extended further to how such sense of global citizen becomes teachers' motivation to continue with the decision of incorporating water resources in their teaching by equipping their students with value-thinking and future-thinking competencies, whereby they are able to negotiate and apply the sustainability values and targets to craft a rich picture of sustainable future (Brundiens et al., 2010; Wiek et al., 2011). This study showed that teachers' past or background experience related to sustainable development and water issues in the lifeworld can engrave their belief in taking the initiative and responsibility in inspiring the future generation to work cooperatively on the peaceful growth and development of our planet. Therefore, they actively consider the contents and pedagogies used in their lessons to attain such goals (Lent et al.,

1994; Fedosejeva et al., 2018; Brown and Lent, 2019). Such belief can be galvanized into persistent actions, whereby they put their beliefs into their teaching and pass them onto the current and future generations in the midst of challenges (UNESCO, 2005, 2017). Another participant said,

...My school is in the Parramatta catchment [an area near the Parramatta River]. I told my students it was not that... contaminated in the 60s. Factories, wastes... you name it... That's the impact of commercialism and capitalism ... Not just us... It's everywhere in the world. I want my students, their parents, and the communities to know that we have to do something together ... My job is preparing them [the students] to manage their water demands. I prepared some rotating workstations and offered them sensory stimuli and first-hand experiences on this issue. It worked ... (Matilda, Australia, second interview)

Teachers who strongly believe that water resources management and water conservation are key to a sustainable future are more willing to bring this topic into their classrooms. Participants reflected that their awareness of the unequal distribution of clean water and access to sanitation facilities makes them feel responsible for putting such issues under the limelight, leading to value and behavioral changes among students. Although previous studies (Miedema and Bertram-Troost, 2015; Fedosejeva et al., 2018) suggested that teachers' beliefs of instilling what and how their students should do and shaping their existential worldview in ESD may lead to a potential switch-off from students and non-attainment of the teaching goals, this study showed that if teachers adopt student-centered learning, whereby allowing room for students to reflect and apply their critical thinking skills, the teaching goals can be attained and students' interests in the water-related topics can be maintained or even amplified. This is echoed by another two participants:

... COVID hits every nation hard ... Some are harder ... Some didn't even get the hand san [hand sanitiser] ... I want my students to know that we are lucky as we are a developed nation ... Some aren't... with spiking cases. I want them to think over what we can do to communicate this [unequal distribution of water and sanitation resources] to other students, parents, the community ... We are in a global village and that's what we have to do ... (Jason, New Zealand, focus group)

... I believe that water sustainability is important. When I was teaching the water cycle, I reminded them 'water security' is a global issue... But I didn't use a teacher-centred top-down approach. They just don't want to listen ... I asked them to research local and global water resources management strategies. They had to do a multi-modal presentation and answer questions from their peers... They felt the greatest takeaway was that global warming changes air temperatures and precipitation patterns... I felt valued ... and grateful that

I could include that [water resources elements in teaching] ... Even we have secured our water supply, it doesn't mean that we need not to conserve water. We do it for ourselves and for all [people around the world] ... (Anson, Taiwan, second interview)

Teachers' self-belief in committing to be responsible for securing the water resources locally and globally become a source of self-efficacy for them to incorporate the water resources component in their teaching. Affirmed with the SCCT hypotheses (Lent et al., 1994; Brown and Lent, 2019), such an increase in self-efficacy allows teachers to overcome the pedagogical challenges and persist in their decisions and actions of incorporating water resources elements in their teaching. Upon their successful implementation, it yields job satisfaction and positive affection, whereby becoming an extra source of self-efficacy to reinforce their belief of obtaining similar success and thus enhancing their motivation in future teaching (Lent et al., 1994; Brown and Lent, 2019).

5.2. Characteristics of the community

Proximal contextual environment in relation to supports and barriers is a determining factor that indirectly influences teachers' self-efficacy and directly influences their outcome expectations, constituting a key factor impacting teachers' motivation (Lent et al., 1994; Brown and Lent, 2019). Previous studies (Summers et al., 2005; Eli et al., 2020) have identified how many proximal contextual barriers, such as poor school managerial and inadequate collegial supports, negatively influence teachers' motivation in ESD. On the other hand, this study sheds light on the proximal contextual supports, particularly the geographical and cultural characteristics of the community as a positive influential factor in teachers' motivation to incorporate water resources into their ESD teaching.

5.2.1. Geographic location

Previous studies (Summers et al., 2005; Hwang, 2013) suggested geography is an appropriate subject for ESD, whereby the directional dimension of sustainability, such as the development of human capital to maintain ecological integrity, can be unfolded while assessing places and regions alongside their histories. This study extended further that geography and geographical location can provide substantial contextual support in different subjects, such as language subjects, to allow students to understand sustainability concepts. Participants in this study are mostly living in the coastal urban area. Such environmental proximity invites them to have higher chances of including myriad field trips and activities to bring in first-hand or personal experiences to students, thereby attaining a better understanding of the relationship between water resources and humans presented in the subject contents. One participant said,

... Students like going to the beaches and the nearby literary trial. While I was teaching the Hong Kong contemporary literature module, I brought my students to the Southern District and Repulse Bay to understand the relationship between human activities, social classes and the shore... [and] how these become the inspiration for the modern Hong Kong writers. They liked it... They could feel that nostalgia... They reckoned beaches are not just the backdrop but represent the burgeoning middle class... (Jeremy, Hong Kong, focus group)

Although Ruiz-Garzón et al. (2021) suggested that learners paid more attention to the marine environment than other water resources due to the coastal homes and schools, participants in this study suggested that the geographical proximity to the oceans does not confine students' interest in issues related to oceans; instead, they are becoming more interested in the broader issues related to water resources. Another participant said,

... Going to the beach for excursions can make children more excited. Somehow I don't think only beaches... They still have the same passion for rivers and lakes... They all formed many million years ago ... Beach is just a stimulus... They [Children] are curious. They want to know more about different precious water resources after their excursion. I remember after our excursion, one student asked questions not about the beach, but about lakes. It's like the trivia question: How many years ago did the Great Lakes of North America form? I'm pretty amazed... I have never met a student from his grade asking this question ... (Karen, New Zealand, second interview)

... Definitely, an environment surrounded by the sea makes them more engaged [in learning] ... But they also like other bodies of water, such as a river, lakes or reservoirs. I brought them to experience a river from different locations. They liked it... They are interested in concepts like watershed... They even build their own monitoring tools to observe, measure... and record the different properties of the river. They could make accurate statements about their interrelationships... That was far more than the previous batch of students... (Anson, Taiwan, second interview)

This study reflected that the outdoor education opportunities related to water resources allow students to elaborate and reflect on their personal experiences gained in the field trips and excursions to understand and appreciate the complex relationship between nature and humanity in these subjects (Mata-Segreda, 2010; Moseley et al., 2020). It further illustrated how such opportunities motivate students to integrate their problem-solving and implementation competencies to plan, realize and evaluate water-related issues (Brundiens et al., 2010; Wiek et al., 2011). Most participants in this study agreed that this kind of field trip could enhance such learning outcomes among students, thereby

encouraging and motivating them to continue with such implementation. Another two participants further elaborate on the attainment of the learning outcomes:

... Water is an important element in Australian literature... Past the Shallows, Aquifer [Work from Australian writers] ... When we were working on the selected poems by Peter Skyrzynecki [an Australian poet], the HSC [the university entrance examination in New South Wales] Belonging module, I brought my students to Duck Creek [a perennial stream in Sydney] and let them feel and imagine how growing up in a place like this would be... They understood the sense of belonging and comfort a migrant gained from the Parramatta river catchment area... empathy I believe... even though they are from a different background. They were more confident in crafting their essays... I really like this cohort... (Matilda, Australia, focus group)

... It's always hard to study ancient Chinese poems and prose. They are infused with traditional Confucian and Daoist beliefs. Both emphasise the proper order, or in an ancient Greek term, Logos, and everything in this Cosmos [universe] is in the right position in the world ... It sounds abstract... But when our class went to Joffre Lakes [lakes in British Columbia] ... The pristine scenery, turquoise blue water ... I just asked them to close their eyes... and feel ... They understood the spirit of 'water and mountain' ... that's the diasporic grief evoked during a journey along the river or lake... It's a way of living ... It's an important and distinct concept in Chinese literature... (Lora, Canada, first interview)

Apart from the sustainability competencies, students' mastery of subject knowledge reflects teachers' ESD teaching goals, reinforcing teachers' professional identity and boosting their confidence (Flores and Day, 2006; Richardson and Watt, 2006). Specifically, students' active participation, alongside their increase in confidence and academic success, becomes an indicator of successful teaching, thereby fostering a positive sense of professional identity among teachers and belief that they can master their teaching competently (Richardson and Watt, 2006, 2018). According to the SCCT, teachers' self-efficacy is also bolstered due to previous successful teaching experiences, their job satisfaction and attainment of the teaching goals, thereby boosting their interest and motivation to continue incorporating the water resources component in their future teaching (Lent et al., 1994; Brown and Lent, 2019).

5.2.2. Cultural influence

Previous studies (Middlestadt et al., 2001; Mata-Segreda, 2010) suggested that educational policies and constitutional organizations are the important operational factors influencing teachers' actions in incorporating marine or water elements in their ESD. However, it remained obscure whether such actions are determined by autonomous or controlled motivations, whereby

teachers experience self-endorsement or avoidance of disapproval or shame when they decide to incorporate water resources elements in their teaching (Watt and Richardson, 2007; Deci and Ryan, 2008). This study responded to such obscurity by suggesting that the prevailing cultural beliefs and norms in the community are internalized to become the participating teachers' autonomous motivations to incorporate water resources component in their teaching (Watt and Richardson, 2007; Deci and Ryan, 2008). One said,

... We are strongly influenced by Confucian beliefs... We all studied the Analects when we were young. Even though we are seemingly more 'westernised' now, these kinds of traditional thoughts still influence us. For example, in the Analects, it said we have to be responsible to ourselves, our family, our community and our environment. When we talk about harmony, it is not just about humans but also about our earth, culture and environment... It's just common that you would bring out this topic naturally in your lesson ... You just feel naturally you want to introduce that [the concept of harmony] ... (Joyce, Hong Kong, first interview)

... In my lesson about the First Nations, I told my students that the Elders and indigenous communities believe that water is sacred ... Water is considered as a traditional knowledge... [in] folklores, songs and ceremonies... My teachers, my parents or even my grandparents taught me that... That's deeply rooted in my mind ... Water is not just a science thing ... or an environmental issue... They then realised that humanity and science are one. Being a history teacher, I can pass it on ... I hope I have more chances [of incorporating water resources component] later this year ... (Ian, Canada, focus group)

This study reflected that teachers acknowledge the value of incorporating water resources in their teaching as the value of such activity has already been embedded in the traditional cultural beliefs, whereby the social responsibility to the environment and water resources protection is stressed in their place of residency (Valenzuela-Morales et al., 2022). This allows the students to reflect and explore how intrinsic and extrinsic values in the social and natural world are normalized and realized contextually and culturally (Brundiars et al., 2010). Apart from developing their values-thinking competencies, it also allows the students to reflect critically on how such values and ideologies can influence their futures thinking. As a result, it also shapes their anticipatory competencies (Wiek et al., 2011). Such affirmation and alignment make teachers more self-determined and motivated to incorporate such elements in their teaching as they find a greater sense of satisfaction and self-endorsement (Deci and Ryan, 2008). When the teachers find greater satisfaction in such teaching activities, they are more willing to spontaneously incorporate water resources elements in their teaching and resource different materials.

... We are a part of nature, and nature is a part of us. Instead of just pointing out pollution, droughts or floods, we must emphasise that water is also a symbol of our national identity ... In the [Higher School Certificate's] prescribed text Past the Shallows, I introduced to water as the motif, representing the emotional turbulence of the alcoholic father and the boys' upbringing in a dysfunctional family... I also mentioned how life in a desolate Tasmanian fishing village... I used Charles Meere's Australian Beach Pattern to epitomise that the beach is our way of living while teaching the Language, Culture and Identity module... I'm glad that I could source that... (Matilda, Australia, focus group)

... Everything is a part of the whole world. I believe many Taiwanese believe in that too ... So I don't consider a lake is a lake, a river is a river ... When I was teaching Sun Moon Lake, I was not teaching Geography. I also touched on the myths and legends... I talked about the Taiwanese aborigines... I'm glad that I'm such capability to do that... Sun Moon Lake is symbolic in our culture... I searched up and showed my students the music videos by Ruby Lin and Sandy Hsu [some famous Taiwanese singers] ... and their song Sun Moon Lake... I mentioned its significance in popular culture. They even recorded and sang me the song at the year's end ... (Anson, Taiwan, second interview)

While teachers incorporate water resources as a teaching component thematically in their subjects, they enjoyed such a creative way to introduce their lesson content alongside the background cultural influences and traditional beliefs. It allows them to make small, deliberate transformations among students to foster their positive and appreciative attitudes towards water resources, thereby boosting their autonomous motivation to further continue their teaching by such incorporation (Gagné and Deci, 2005; Deci and Ryan, 2008; Zeng et al., 2022). Another participant affirmed this:

... I always navigate around IT to source different ways to introduce those topics [topics related to water] ... We love water. But there is much behind our pristine green image. When I introduced the topic of climate change and pollution, I showed them a video taken by a drone on our waterway ... I showed them [the students] models of different forecasts... I set up polls and surveys to gather their key takeaway of this topic ... They all took out their devices... Students loved that... I just like going creative... I believe I might get the funding on VR headsets next year to go further ... (Jason, New Zealand, second interview)

This study showed that the dominating cultural belief in the communion between man and nature motivates teachers to spontaneously consider various mediums and materials to introduce the water-related subject content (Gagné and Deci, 2005; Deci and Ryan, 2008). While teachers modify their practices and engage

students in a contextualized interpretation of the sustainable development principles related to water resources, they obtain success in improving students' academic competency alongside the appropriate values and attitude towards water resources in their classroom, whereby it becomes their background experiences serving as the source of self-efficacy, allowing them to postulate similar successful teaching in future (Biasutti et al., 2018; Brown and Lent, 2019). Affirmed with the SCCT hypothesis, such an increase in self-efficacy, alongside the postulation of the successful teaching goal attainment, increases teacher's motivation for incorporating water resources elements as a regular component in their future teaching (Lent et al., 1994; Brown and Lent, 2019).

6. Limitations and future research directions

This study has accentuated several personal and contextual factors to motivate teachers to incorporate water resources elements in teaching by examining the relationship between self-efficacy, outcome expectation and performance goal attainment. Nevertheless, it shows several limitations. First, the relatively small sample size of participants may affect its generalizability; therefore, the researchers suggest expanding future research by including a larger sample of participants (Almeida et al., 2017). Second, this study did not include quantitative data due to its purpose of unfolding the teachers' teaching experiences. Further research can be done by adopting mixed methods like surveys to evaluate the teaching and learning outcomes from the students' perspective (Biasutti and Frate, 2017). As a result, the duration of activities, assessments and students' attainment of learning outcomes can be evaluated to develop an effective teaching programme or plan for school implementation. Third, this study's participants are mainly from developed countries. Further comparative research across higher and lower socio-economic backgrounds can be done to examine the impact of some specific contextual variables (Brown and Lent, 2019).

7. Conclusion

This study is a novel international one contributing to the fields of ESD, environmental education and water education by focusing on the motivations and teaching experiences of different subject teachers incorporating water resource elements in their teaching. By looking into their experiences, the findings showed some personal and contextual factors that motivated teachers in incorporating water resources in their teaching. This relates both to the local and global water-related issues, as well as the teachers' educational beliefs related to ESD, especially critical thinking, reflection and changes in beliefs, values and attitudes. Particularly, this study shed light on the possibilities of incorporating water resource components in different disciplines and how they can successfully attain teachers' teaching goals and boost teachers'

motivation for future implementation. Despite the limitations, this study's findings can provide insights into how and why teachers' personal beliefs and contextual variables like geographic and cultural influences can encourage teachers to implement water resources elements in their teaching, thereby illuminating the possible responsive pedagogies for successful cross-disciplinary ESD in future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by this study is supported by Woosong University Academic Research Funding 2022. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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