Can Ocean Literacy Save Our Coastal School?

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Abstract

Protecting coastal ecosystems and communities requires the engagement of ocean literate citizens. Along the St. Lawrence Estuary, in Canada, a rural community mobilized to save its middle school by creating an innovative program connecting the existing curriculum to the ocean. This research explores the rationale, barriers, and enablers of including ocean literacy in schools through a case study of this program. Interviews and surveys with school community members showed that although the school managed to stay open, the program faces considerable barriers, including the lack of an educational framework, educational resources, and funding. Support from community members and access to a coordinator were the program's greatest enablers. From these findings, I develop recommendations to support the establishment of similar programs in other schools.

Résumé

La protection des communautés et écosystèmes côtiers nécessite l'engagement de citoyens sensibilisés aux enjeux océaniques. Sur les bords de l'estuaire du Saint-Laurent, au Canada, une communauté rurale s'est mobilisée pour sauver son école en créant un programme novateur qui intègre l'océan au programme scolaire des élèves du début du secondaire. La présente étude de cas explore les fondements, les obstacles et les facteurs facilitants de l'intégration de la connaissance de l'océan dans les écoles. Les entrevues et sondages réalisés auprès des acteurs du milieu scolaire ont montré que, bien que l'école soit restée ouverte, le programme a dû surmonter plusieurs obstacles, dont le manque d'un cadre éducatif, de ressources pédagogiques et de financement. Le soutien des membres de la communauté et l'accès à un coordonnateur ont été les facteurs facilitants les plus importants. Ces conclusions ont permis de formuler des recommandations pour appuyer l'établissement de programmes semblables dans d'autres écoles.

Keywords: ocean literacy, coastal communities, formal education, case study, Quebec

Mots-clés : connaissance de l'océan, éducation relative à l'océan, communautés côtières, éducation formelle, étude de cas, Québec

Introduction

As coastal ecosystems are influenced by both inland and marine human activities, their sustainable development requires in-depth understanding of the human impacts on the ocean and in turn, the impacts of the ocean on us

(Crain et al., 2009). In the sustainable development literature, many papers call for "more education," especially more environmental (e.g., Österblom et al., 2020) or marine education (Gough, 2017; McKinley & Fletcher, 2012; Schoedinger et al., 2006). Marine education can develop ocean literacy, most often defined as an understanding of "the ocean's influence on us and our influence on the ocean" (Santoro et al., 2017, p. 15). Ocean literacy matters for the management of coastal ecosystems, as ocean literate citizens are empowered with the ability to make responsible decisions regarding ocean resources (Santoro et al., 2017).

Responding to calls for "more marine education" is a very complex undertaking. While calls for more ocean literacy often originate at the international or national levels, education is managed at the provincial and local levels. In Canada, marine education falls in a jurisdictional gap. In fact, the dynamic and interconnected nature of the ocean continuum (land, water, coasts, sea ice, open ocean, as defined by Glithero, 2020) itself defies jurisdictional boundaries and zones, much like education. On the one hand, ocean management is primarily the responsibility of the Department of Fisheries and Oceans Canada (DFO). The DFO has neither an educational mandate nor extensive funds for education. On the other hand, the Quebec Ministry of Education affirms that environmental issues do not concern its sector (Sauvé et al., 2018). As a result, there are currently little to no ocean-related concepts in Quebec's kindergarten to Grade 12 curricula (Quebec Ministry of Education, 2006; Quebec Ministry of Education, n.d.). Teachers across Canada struggle to include ocean concepts in their classroom because they face barriers such as lack of time and resources (McPherson et al., 2020). This is especially true of teachers in rural regions, where financial, human, and material resources are even scarcer (Arena et al., 2009).

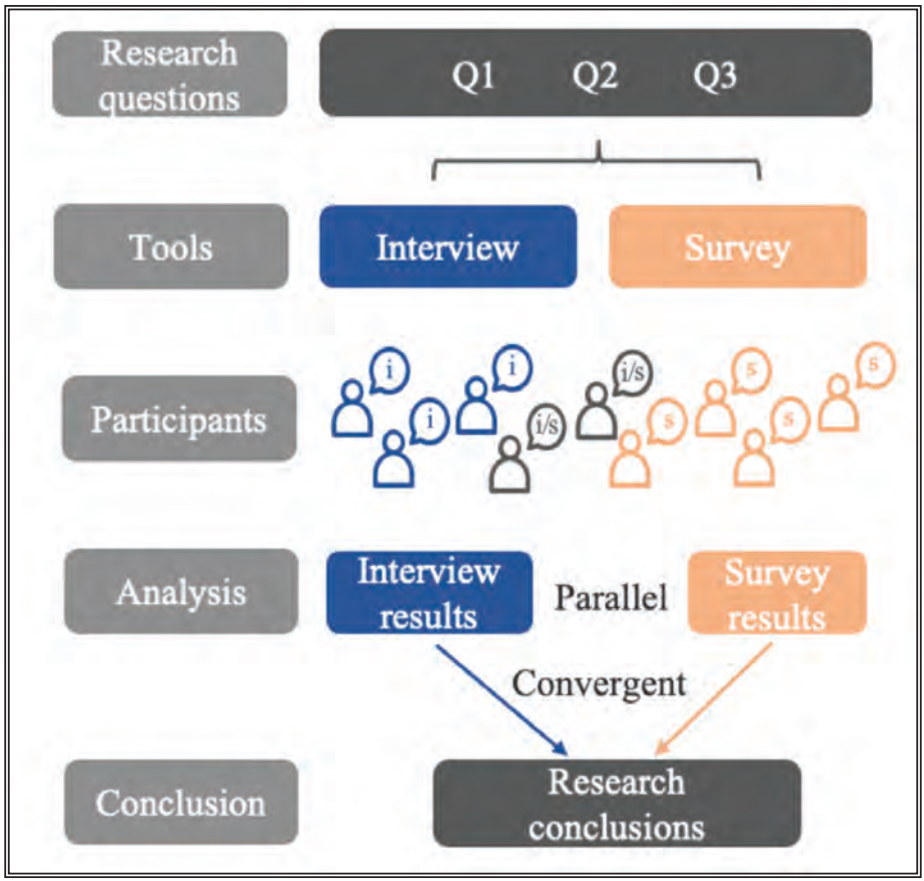
On the shores of the St. Lawrence Estuary, in Quebec, a small middle school (25–30 students) managed to bring the ocean into their classrooms using a unique community-based approach. The school community is deeply attached to their school and to the sea, which can be seen, heard, and smelled from almost everywhere in the community. Like many small coastal communities, the future of this town is increasingly uncertain. From 2011 to 2016, the population declined by 2.6% (Statistics Canada, 2016). In 2016, the school board threatened to close this community's middle school. To save their school, community members created a program through which students learn about the ocean in all school subjects. The program is called *Le Saint-Laurent dans ma classe*, or "The St. Lawrence in my classroom" (pseudonym). Teachers follow Quebec's Grade 7 and 8 curriculum but apply it through an oceanic lens. For instance, students learn to scuba dive in their physical education class, read about phytoplankton in their French class, and study plastic pollution in their geography class.

Initially, I selected this unique program as a case study of the influence of ocean literacy in formal school settings on the students and school community (parents, teachers, administrators, and community partners). However, in

conducting this research, an unexpected narrative emerged. While the school community was keen to increase ocean education (they did not use the term ocean literacy or its French equivalent, *connaissance de l'océan*), their primary goal was to save their school and increase the resilience of their small coastal town. The reality of this precarious school community suggests that implementing calls for more marine education comes with many challenges. The purpose of this case study is to gain a more granular understanding of the complexity of implementing ocean literacy in the school system, and to inform educators and policy makers seeking to implement such initiatives. To achieve this purpose, I aim to answer the following research question: "How can formal education foster ocean literacy in coastal school communities?" By formal education, I refer to education in schools through institutionalized education (UNESCO Institute for Statistics, 2012). I answer this research question by exploring the program *Le Saint-Laurent dans ma classe* through the following sub-questions: "What are the barriers associated with the implementation and sustainability of this program?" and "What are the enablers associated with the implementation and sustainability of this program?"

Methodology

This research is a case study of the program *Le Saint-Laurent dans ma classe*. More specifically, I look at the creation and the first three years of implementation of the program (2017/2018, 2018/2019, 2019/2020). A case study methodology has the potential to provide in-depth analyses and concrete examples of how calls for more ocean education can be implemented in a complex jurisdictional context. This research can be classified as an explanatory case study (Yin, 2014). This type of case study facilitates the explanation of particular phenomena or events (Yin, 2014), in this case, the events leading to the integration of ocean literacy into formal education. To complete this case study, I used a mixed-method approach, combining semi-structured interviews and a survey. A mixed methodology combines strengths from both quantitative and qualitative methodologies (Greene et al., 1989). Each research question required multiple perspectives in order to be answered and was therefore addressed using both interviews and a survey (Figure 1). For instance, the survey afforded the opportunity to ask participants whether they thought factors that had been identified in the literature (Glithero & Zandvliet, 2020; Gough, 2017; Lambert & Sunburg, 2006; McPherson et al., 2020; Stewart, 2019) were barriers, enablers, or neither to the delivery of the program. In the interviews, participants were asked to name barriers and enablers without being provided with a list of factors. The survey allowed me to test if the barriers and enablers experienced within this program are the same as the ones described in the literature, while the interviews allowed participants to share other barriers and enablers without being influenced by a list of pre-selected factors.



Note. Q1, Q2, Q3 refer to my three research questions. This figure shows that I answered all three questions using both interviews and a survey. Participant icons identified by an "i" represent participants to interviews only (n = 3). Participant icons identified by an "s" represent participants to the survey only (n = 4). Participant icons identified by "i/s" represent participants in both methods (n = 2). Icons adapted from Flaticon (https://www.flaticon.com/).

Figure 1. Conceptual Representation of the Study Design

The study population included all adults who are or have been involved in the program *Le Saint-Laurent dans ma classe*. This included parents of current or past students in the program, all current or past members of the school staff since 2017, all current or past members of the governing board since 2017, and any community member involved in the program. I contacted participants by email. I had five interview participants: one current teacher, one past teacher, two members of the governing board of the school, and one involved community member. Interviews took place from May to July 2020.

I audio-recorded and then transcribed each interview. I conducted a thematic analysis of the interviews in French, their original language, using NVivo12. The interview process was complemented by an online survey. I built the survey in French, on the online platform Opinio. It was pre-tested by five people. In total, six people completed the survey, including two participants from the interviews. One of the six survey participants completed the entire survey with the exception of one question. The survey was open from May 24 to June 8, 2020. As only a small number of participants responded, I analyzed survey results descriptively rather than statistically.

This mixed methodology was conducted in a convergent parallel design, meaning that I analyzed interview results independently from survey results (Halcomb & Hickman, 2015). I used this design to obtain two complementary datasets for each research question. The convergent parallel design allowed me to give equal priority to both research methods (Halcomb & Hickman, 2015). This methodology was approved by the Marine Affairs Program Ethics Review Standing Committee in April 2020 (MAPERSC #: MAP2020-01).

The COVID-19 pandemic led to some limitations. The greatest impact was on recruiting study participants, since not being able to travel to the community reduced my ability to meet directly with community members, parents, teachers, and school staff. In addition, schools were in turmoil in the spring of 2020, with school closures directly limiting participant availability to participate in my study. Fortunately, I was able to connect with participants from the four identified populations (school staff, parents, governing board members, and community members) to provide a range of perspectives on the project. Since I was conducting a small case study, focusing on only one program at one school, the validity of my method depended on the depth of the information I collected rather than on the amount of information. Therefore, the low numbers of participants do not invalidate my findings. Another limitation linked to the pandemic was that I was not able to collect in-person data for this project. Being physically in the environment where the program takes place would have allowed me to observe how students engage with the program, for instance, through artwork or other projects displayed at the school.

Furthermore, I did not include students as study participants. Involving youth would have required a different research approach in order to ethically engage them in the research. The new sociology of childhood recognizes children as active agents in the research rather than solely as research objects (Kirk, 2007). When conducting research on children, Green and Hill (2005) recommend engaging children in every step of the research process. Properly undertaking such an approach takes time, especially to address concerns in research with children, such as power relations, informed consent, and confidentiality (Kirk, 2007). For instance, children participating in research may not be used to disagreeing with adults (Hill, 2005) or may feel as if they have less power than adults (Freeman & Mathison, 2008). I chose not to engage with students rather than engaging

with them in a superficial and possibly unethical way. However, this is a notable research gap as students are a central part of the school community and I hope future research can include their voices and perspectives.

Results

In this section, I present the context surrounding the creation of the program *Le Saint-Laurent dans ma classe* and its first three years of implementation (2017/2018 to 2019/2020). Then, I present in more detail the barriers and enablers of the program, first by exploring the interview results, second by analyzing the survey results, and third by combining the results of both methods. By combining the results, I provide an overarching view of how the data answer the research questions.

Context of the Case Study

The St. Lawrence middle school has the St. Lawrence Estuary in its backyard and many marine researchers, fishers, and storytellers in its community. In this context, *Le Saint-Laurent dans ma classe* becomes an opportunity for intergenerational connections and place-based education within the community. Place-based education roots the learning process in the local context (Sobel, 2004). Students learn about many topics throughout the year, several of which directly affect their community. For instance, they learn about marine plastics, marine mammals, and marine careers, and they meet with local experts on these topics. As the students interact with community members, they begin to develop their ocean citizenship and become ambassadors of the sea in their community.

Initially the program was successful, resulting in the school board deciding not to close the school. However, the school is still in a precarious situation. Only 29 students registered for the 2020/2021 school year. The principal is managing two elementary schools in addition to the St. Lawrence middle school without the help of a vice-principal. Only three teachers out of seven work full-time at this school. Additionally, high staff turnover and low funding availability make managing a long-term program such as *Le Saint-Laurent dans ma classe* difficult. Unfortunately, like many school change initiatives (Askell-Williams & Koh, 2020), the program created a lot of enthusiasm at the outset, but rapidly lost momentum over the years (Figure 2). A consultant in marine education helped create and implement the program in the first year. This consultant brought a lot of ideas and energy into the program. However, lack of funding prevented the school from rehiring this consultant in the following years. Then, a change of teachers and a new principal made it difficult to keep the program going. Finally, the COVID-19 pandemic stopped the school from doing any program activities in the last months of the 2019/2020 school year.

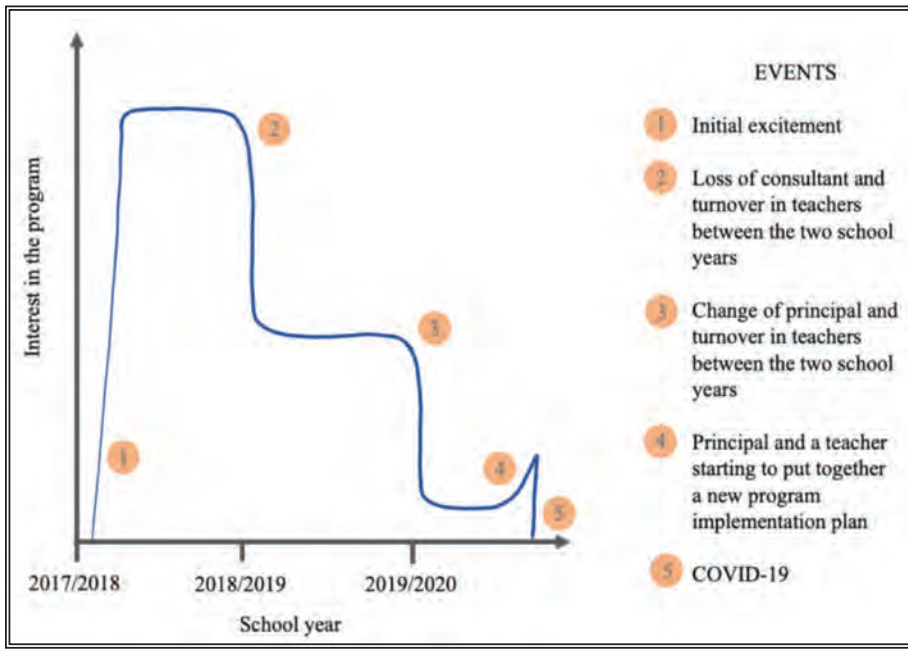


Figure 2. Variation in the Interest in the Program Over the First Three Years

Challenges such as lack of funding, staff turnover, and educational resources are common in rural schools in Quebec (Arena et al., 2009). As Arena et al. (2009) explain, in Quebec's remote regions, populations tend to decrease, leading to a decrease of students in schools. As schools are funded based on their size, schools with fewer students receive less funding. Therefore, these schools have to teach with less equipment, supplies, and staff resources (Arena et al., 2009). Moreover, many non-formal education resources, such as museums, aquariums, and educational centres, are located in urban areas and are difficult for schools outside these areas to access. For rural schools, visiting these locations requires full-day field trips, expensive transportation, and funding.

Barriers to the Program

Through the interviews and surveys, I explored in more detail the barriers leading to a decrease of interest in the program.

Results from the interviews. During the interviews, I asked participants to identify the main barriers to the implementation and sustainability of the program. Lack of support for the program, turnover in staff, and work overload were the three most frequently identified barriers. The COVID-19 pandemic was also mentioned as a barrier.

i. Lack of support. Not rehiring the consultant after the first year of the program meant that teachers were asked to prepare all program activities. Teachers who were present in the first year of the program compiled activities in a folder so that these could be reused by future teachers. However, such a folder does not replace a skilled consultant with extensive community contacts and expert knowledge. Another challenge associated with losing the consultant was that the program now lacked coordination. As one teacher put it, "Everybody thinks that someone else will do it [organizing activities] and in the end no one does it."[1] Because of this dynamic, teachers organized significantly fewer activities in the second and third years of the program than they did in the first year (Figure 2).

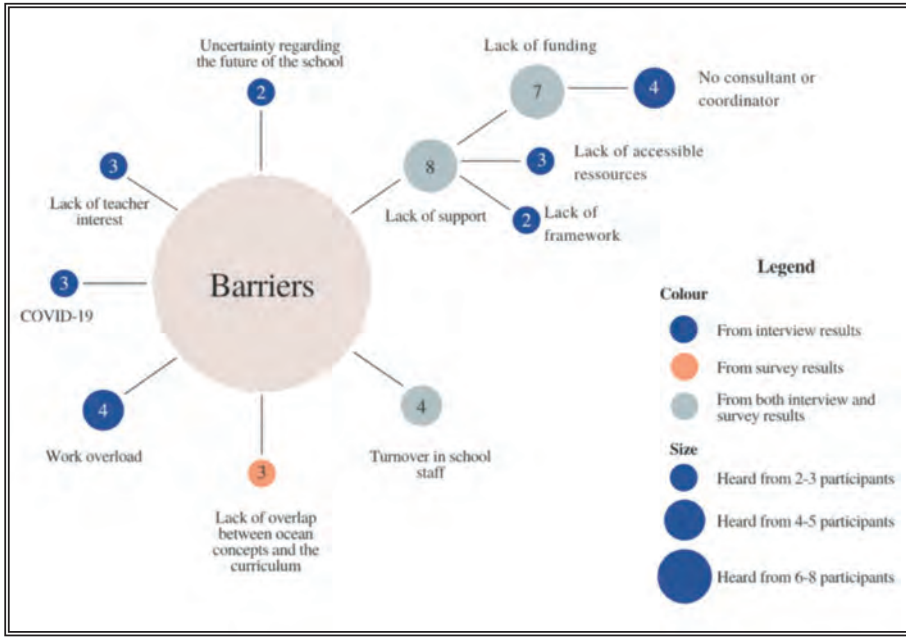
ii. High turnover in staff. The interviews also identified the turnover in school staff as a barrier. The program was implemented in 2017/2018 with a team of seven teachers and one principal. All teachers but one were replaced for the 2018/2019 school year. Before the start of the 2019/2020 school year, the principal retired and four teachers were replaced, including the only teacher left who had experienced the first year of the program. Finally, for the 2020/2021 school year, four teachers were again replaced.

Turnover in teachers impacts program momentum and leads to varied interest in the program from one year to the next. A successful activity is difficult to repeat without the teacher who initiated it, as its delivery often depends on the teacher's interests and relationships. Turnover in teachers also makes it hard to plan for the following school year. Elementary, middle, and high school teachers in Quebec only learn in July whether they will be teaching at the same school the following September. As one participant explained, "There is so much movement in the personnel that no one plans the following school year [in advance] because it will not necessarily be the same team redoing it in August."[2]

iii. Work overload. Participants expressed that teachers and the school principal struggled with the addition of program responsibilities to their regular responsibilities, as well as the difficulty of finding ocean education resources. As many teachers at this school teach in multiple schools, they have a lot to manage. The barrier of work overload relates to the barrier of a lack of support. The teachers I interviewed felt that the lack of a framework and the lack of help to find resources contribute to why they feel overwhelmed.

iv. The COVID-19 pandemic. Participants mentioned the COVID-19 pandemic as a barrier. From March 2020 to the end of the school year in June, the school was closed and students were learning from home. Because of the challenges of remote teaching (e.g., adapting courses to the online environment, being able to meaningfully connect with students through technology) and the general context of uncertainty, no activities related to the program were completed during this period. In fall 2020, the school reopened. The teachers had planned to start the year with a whale watching expedition. However, as field trips were prohibited in the fall 2020, they pushed this expedition to the end of the 2020/2021 school year.

Results from the survey. The survey also allowed barriers to the program to be identified. From the list of factors presented to survey participants, two stood out as barriers: lack of funding and lack of overlap between ocean concepts and the provincial curriculum. I did not include the factor of turnover in teachers in the list, but a survey participant suggested it as an additional barrier.[3]



Note. The numbers in the bubbles indicate the total number of interview participants that identified this factor as a barrier to the implementation and sustainability of the program plus the total number of survey participants that indicated this factor was "always a barrier" or "sometimes a barrier," or identified the factor as a barrier in the comment section of the survey. If a participant identified a factor as a barrier in both the survey and the interview, I only counted it once.

Figure 3. Barriers to the Implementation and Sustainability of the Program Le Saint-Laurent dans ma classe

Figure 3 combines the results from the interviews and the survey on the barriers to the program. As shown in the figure, lack of support was the greatest barrier to the program. Lack of funding, which falls under lack of support, was also particularly important as it prevented the consultant from being rehired.

Enablers of the Program

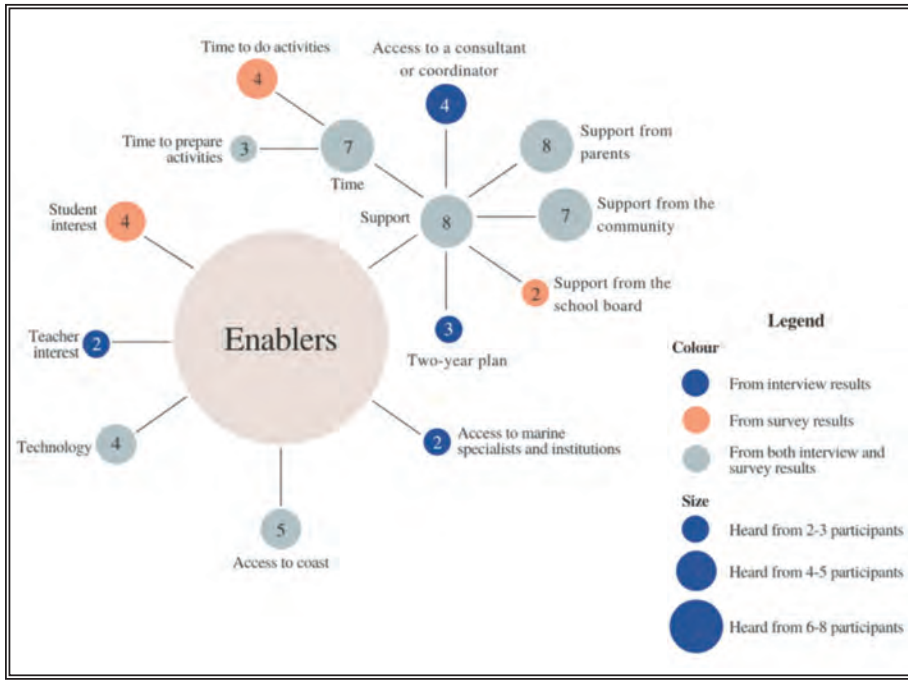
Even though the program faced many barriers, it also benefitted from enablers. Both interview and survey participants identified enablers of the implementation and sustainability of the program.

Results from the interviews. Participants discussed what enablers of the program were important in the past, important in the present, or could be important in the future. In the past, having the help of a consultant enabled the school to implement the program. In the present, having the support of a motivated team of parents and school community members, and having many specialists and marine institutions close by supported the implementation and sustainability of the program. In the future, the school is planning to implement a two-year plan with fixed activities and themes. They hope that this plan will increase the program's sustainability.

i. Past enablers. The consultant's experience in, and holistic vision of, the marine field in Quebec allowed students to benefit from activities that would not have been possible otherwise. A participant gave some examples of activities organized by this consultant: "It was always passionate people. […] We had at one point a writer, who told us his story. The children did scuba diving. It never stop[ped]."[4] Teachers often feel that they lack the skills and knowledge to share complex (McPherson et al., 2020) or controversial (Payne & Zimmerman, 2010) ocean concepts with their class, such as waste management or political commitments to climate justice. A consultant can support teachers in addressing these topics.

ii. Present enablers. Parents and school community members first initiated the program and have continuously supported it. As one participant said, parents and school community members allowed the program "to stay on course so that transitions happen with great motivation."[5] Some of them are part of the school governing board, to which the school has to periodically report on the state of the program. Moreover, many school community members volunteered to come to the school and share their knowledge and passion. As many of these people are marine researchers, storytellers, fishers, or members of the coast guard, this is an "invaluable resource."[6]

The region around the school is home to many marine research institutions and marine industries—some of the main economic sectors in the region. Teachers hope the program increases the career literacy of the students and encourages them to stay in the community as adults. Retaining youth is imperative for the resilience of this small community. The proximity of these institutions and industries to the school creates affordable opportunities for the school to invite presenters and visit marine research centres and infrastructure. The affordability of these opportunities increases the likelihood of having access to these activities in the long-term and allows the school to build these activities into a two-year plan.



Note. The numbers in the bubbles indicate the total number of interview participants that identified this factor as an enabler to the implementation and sustainability of the program plus the total number of survey participants that indicated this factor was "always an enabler" or "sometimes an enabler," or identified the factor as an enabler in the comment section of the survey. If a participant identified a factor as an enabler in both the survey and the interview, I only counted it once.

Figure 4. Enablers of the Implementation and Sustainability of the Program Le Saint-Laurent dans ma classe

iii. Possible enablers in the future. The principal and a teacher developed a two-year plan in early 2020 (Figure 2) and implemented it in September 2020. The plan provides teachers with a framework with four themes per year (eight themes in total) and fixed activities. It also identifies a local expert for each theme who would come to the school every two years to give a presentation. This two-year plan makes the program delivery simpler for teachers as they now have a framework to rely on and do not have the responsibility of finding and inviting local experts.

Results from the survey. The factors identified as enablers in the survey were similar to the enablers from the interviews. Survey participants highlighted support from parents and the school community as enablers. Access to the coast was identified as "always an enabler" by four survey participants. Additionally, survey participants identified time to create activities and student interest as enablers.

Survey participants added two factors as enablers that did not appear in the list in the survey: One participant indicated collaboration between colleagues as "always an enabler"; another participant indicated support from the school principal as "sometimes an enabler."

Figure 4 combines the enablers identified by interview and survey participants. Interestingly, I identified lack of support as the main barrier to the program (Figure 3) and support as the main enabler of the program. Support from parents, the community, and time to prepare and conduct activities all act as program enablers.

Discussion

Many of the barriers and enablers presented above relate to literature on environmental and marine education. In this section, I expand on these barriers and enablers to develop recommendations for other schools wishing to establish similar programs.

Barriers to the Program

Since its inception only three years ago, the program *Le Saint-Laurent dans ma classe* has faced many barriers. These barriers are similar to the ones met by other schools trying to deliver environmental education programs. McPherson et al. (2020) interviewed high school science teachers in Nova Scotia about the challenges of integrating ocean science into their courses. The teachers identified an overloaded curriculum, lack of educational resources, and lack of time as barriers. Teachers said that as long as ocean concepts are not included in the curriculum, they are likely to remain marginalized. Finding creative ways to integrate ocean content with the current curriculum content is possible, but only to a certain extent.

Another major barrier identified at the St. Lawrence middle school was turnover in staff, which comes with significant costs. Barnes et al. (2007) found that in the United States, at the time of their study, replacing a teacher could cost from USD 9,000 to 20,000. These costs were for recruitment, hiring, and training. The barrier of turnover in staff can therefore be linked to that of lack of funding. In addition to monetary costs, turnover can have an impact on the students, who have been shown to suffer from a decrease in teaching quality (Carver-Thomas & Darling-Hammond, 2017). The difficulty in filling teaching positions can lead to teachers being hired right before the start of a new school year, leaving little time for planning and program preparation. There is also a risk of teachers with inadequate training being hired to fill empty positions (Carver-Thomas & Darling-Hammond, 2017).

The St. Lawrence middle school may have to bring teachers from outside the area to replace teachers who have left. It is likely that it would take time

for teachers who are new to the area to establish deep relationships with the community and understand its history, challenges, and connection with the ocean. The program *Le Saint-Laurent dans ma classe* is anchored in the local context, and relationships with the community are at the heart of place-based education (Leather & Nicholls, 2016). Teachers need to understand the lived experience of the students to adequately support them in their transition from elementary to high school—a period of high emotional, social, and behavioural change (Longobardi et al., 2016). If teachers are constantly changing, they may not have the time to establish the meaningful relationships needed to deliver the program and fully support their students.

Enablers of the Program

Since the creation of the program, the St. Lawrence middle school has relied heavily on the support of the school community. According to Arena et al. (2009), educational programs that engage with the local community are key to the economic and social viability of rural communities in Quebec. Partnerships with the local community allow the exchange of knowledge between the students, teachers, and the local community. Uzzell (1999) describes four types of school-community partnerships: school as an isolated island, local community invited into school, school as a guest in the community, and school as a social agent. When the school acts as a social agent, students collaborate with the community to address local environmental issues. This type of partnership is likely the most effective at helping the students become agents of change (Uzzell, 1999).

In the program *Le Saint-Laurent dans ma classe*, most interactions with the local community are through either guest presentations by community members or field trips in the community. However, the school completed a beach cleanup in 2017 and left a bucket on the beach to encourage other community members to pick up garbage. This action could be considered an example of the school acting as a social agent. For this role to become clearer, and to further help students become agents of change, events like this one should involve greater collaboration between the students and the community members. For instance, the students could pick up garbage alongside local community members through a community cleanup event. Another way for the school to become an agent of change would be for students to partner with the municipal council as participants in the local democracy and decision-making processes. At the Girrakool primary school, in Australia, the environment is integrated into all aspects of the curriculum (Kennelly et al., 2011), much like the ocean at the St. Lawrence middle school. Students from the Girrakool primary school presented on water management to their local council (Kennelly et al., 2011). Students at the St. Lawrence middle school could do the same for their own local council, and this activity could be integrated into the new two-year plan.

The two-year plan implemented in September 2020 will hopefully ensure longer-term stability of the program *Le Saint-Laurent dans ma classe*. During interviews in July, teachers informed me that this two-year plan would include set activities, themes, and presentations by specialists. In September, I contacted a teacher as an informal follow-up to an interview completed in July. During this informal discussion, I learned that between July and September, the school realized the advantages of allowing teachers to decide for themselves which activity to organize in their classes. This autonomy gives teachers space to exert their professional judgement and to collaborate in innovative ways (Ralph et al., 2020). Teachers had access to the folder with past marine activities but were given the freedom to pick an activity from the folder or to do something different. The school decided to keep the themes and invited experts included in the two-year plan to provide a framework for the program.

During this same discussion in September 2020, I learned that the implementation of the two-year plan went very well. The first theme of the year was marine plastic pollution, and the school had already conducted multiple activities on that topic. For instance, students received a presentation on *Mission 100 tonnes* [100 Tonnes Mission] (http://www.mission100tonnes.com), a campaign aiming to collect 100 tonnes of garbage from waterways. Following the presentation, they collected garbage on the beach behind the school. They then planned to complete a mural with the garbage for their art class. Three activities over the single month of September are a significant increase over the few activities completed over the entire 2019/2020 school year, showing the potential of this new approach.

The location of the school was an enabler that tied many of the program's characteristics together. The relevance of the program's marine theme to the community emerged from its coastal location. Having access to marine experts, institutions, and industries was also linked to this location. Place-based education is a recognized approach to helping participants in educational programs (students, teachers, parents, etc.) feel more connected to where they live (Meichtry & Smith, 2007). It encourages participants to engage in such programs because they understand their relevance (Powers, 2004). The fact that the activities in the program *Le Saint-Laurent dans ma classe* were based on the reality of the coastal community enabled engagement from the school community.

Recommendations

Through this research, I found that teachers at the St. Lawrence middle school feel unsupported when it comes to teaching ocean concepts by themselves, even though they have the backing support of parents and school community

members. They feel proud to be part of this program, but they lack the support of a community of practice and struggle to find resources. Based on these results and the literature, I identified three recommendations for schools who wish to overcome barriers related to the implementation of ocean literacy programs: (1) identify a program coordinator, (2) provide teachers with professional development opportunities, and (3) develop partnerships with other schools and organizations.

Assigning a program coordinator. Having access to an educational consultant enabled the early development of program but was not financially sustainable. Non-governmental organizations (NGOs) might be interested in taking on this role at a reduced cost. Other options include collaborating with a university professor of teacher education or selecting a school teacher to become the program coordinator. At the Girrakool primary school, a teacher was appointed as the "environmental education leader." Having this leader was a major driver of the school's environmental education program (Kennelly et al., 2011). However, in the case of high staff turnover, having someone outside the school as a coordinator may be best for the stability of the program.

Offering professional development for teachers. I recommend that schools seek professional development opportunities through existing environmental education communities of practice and through emerging ocean literacy communities of practice (e.g., Glithero, 2020; Santoro et al., 2017). Henderson and Tilbury (2004) recommend professional development as a way to overcome the challenges associated with change in the school system. In fact, professional development "can assist teachers by providing support and motivation to implement changes [...] and building capacities for institutional change" (p. 22). Professional development could also help sustain teacher interest in the program.

Developing partnerships outside the school. To access more marine education resources, schools can collaborate with non-formal education programs; Henderson and Tilbury (2004) and Arena et al. (2009) recommend collaboration with existing initiatives to enrich educational programs and avoid duplication of work. For instance, the St. Lawrence middle school already benefitted from their collaboration with *Mission 100 tonnes*. This collaboration was highly valuable as it helped teachers gain experience in hands-on, placed-based education.

Partnerships could also be established with other schools to develop a local community of practice. This collaboration can be as simple as sharing activity ideas with other schools in the area. Such a collaboration would allow teachers to connect with other people who understand the reality of teaching in their region. Teachers could then learn from each other's experience, share resources, and develop collaborative projects.

Conclusion

The program *Le Saint-Laurent dans ma classe* was not solely created as a planned initiative to increase ocean literacy. Rather, it was implemented as an ad hoc measure, driven by the urgent need to save the school. Since its implementation in 2017, the program has met many barriers, such as a lack of educational resources and a lack of funding. The COVID-19 pandemic also brought new challenges to the school and local community. Although the future of the program is uncertain, the school community has already managed to overcome many barriers. This is because the program addresses the needs of the community—including the need to save the school—and builds on the strengths of its committed local community and its connection to the St. Lawrence Estuary. Participants in this study made it clear that what made this program so special was the fact that it was anchored in the school's local context. This characteristic of the program is at the root of its resilience. If other similar programs are implemented in Canada, they should also be tailored to their own local context. Moreover, the St. Lawrence middle school continuously modified the program based on feedback from the people involved. New programs should also be continuously reviewed to allow for greater adaptive capacity.

This case study may inspire other schools to build upon their local strengths to foster ocean literacy and resilience among their community. The creation of multiple locally relevant and adaptive ocean literacy programs across Quebec and Canada would allow for the emergence of a collaborative network of schools that are connected to the ocean and to each other, each strengthened by their local uniqueness and regional diversity. This, in turn, would create opportunities to foster resilience in coastal communities and sustain their crucial relationship with a rapidly changing ocean.

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Footnotes

Original quotes from participants:

1 "Tout le monde se dit que quelqu'un d'autre va le faire, et ça finit que personne ne le fait."

2 "Il y a tellement de mouvement niveau du personnel qui se font qu'il n'y a personne qui planifie la rentrée scolaire qui va suivre [en avance] parce que tout est à recommencer au cours du mois d'août avec pas nécessairement la même équipe."

3 "Roulement du personnel enseignant"

4 "C'était toujours des passionnés. [...] On a eu un moment donné un écrivain qui nous a conté son histoire. Les enfants ont fait de la plongée sous-marine. Ça ne s'arrête pas."

5 "Garder le cap pour que les transitions se fassent avec une grande motivation"

6 "Une ressource inestimable"

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