

Marine Education: Teaching for the Future

Gillian Kidman^{1*}

¹School of Curriculum, Teaching and Inclusive Education, Faculty of Education, Monash University, Australia

Abstract. This keynote presentation was developed to provide a baseline research understanding of marine science education. The aim is to provide an entry point for conversations among educators of marine education in Southeast Asia, particularly Indonesia. Conversations are needed to develop the perceptions of marine education among policymakers not only in education but also in the economy. Marine education is under-researched and under-taught in most countries, even those with long coastlines. Yet, without our oceans, life on Earth cannot exist. This paper presents a rapid review of 149 research papers located in a systematic search of the ERIC via ProQuest that followed the PRISMA exclusion process. The findings are presented as eight themes and a set of recommendations.

* Corresponding author: gillian.kidman@monash.edu

1 Introduction

With 71% of the earth's surface covered by water, and this water being 97% of the total water on the planet, we can see that the oceans are essential for supporting life on Earth [1]. However, we neglect this life resource, we rarely teach about it, and we rarely research its significance. This presentation aimed to provide a rapid review of the educational research published in the past ten years to provide an entry point for conversations among educators of marine education in Southeast Asia, particularly Indonesia.

As a starting point, I considered why such a review was needed. I mapped out who attended the ICOME 2023 Conference and, who we were teaching, what we needed to teach, to whom. This revealed that our work has vicarious influences on the community (see Figure 1).

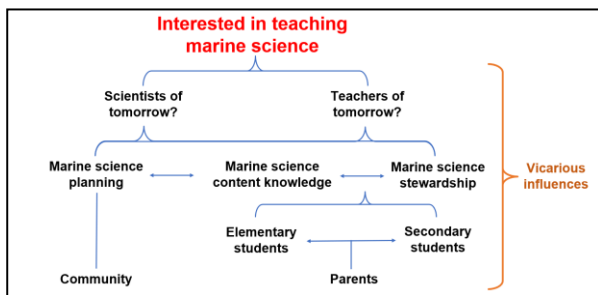


Fig. 1. ICOME 2023 Marine Science Recipients

Figure 1 led to the compilation of keywords and search terms for the rapid review. In this presentation, I chose not to provide a literature review of the related literature, this paper is the review itself.

2 Methodology

The PRISMA process for systematically excluding research papers was followed [2]. This is included in Figure 2. I selected the term marine over maritime as that appeared to be the most widely used term in a preliminary database search. I also used the following search terms: ocean literacy, marine science, and marine education.

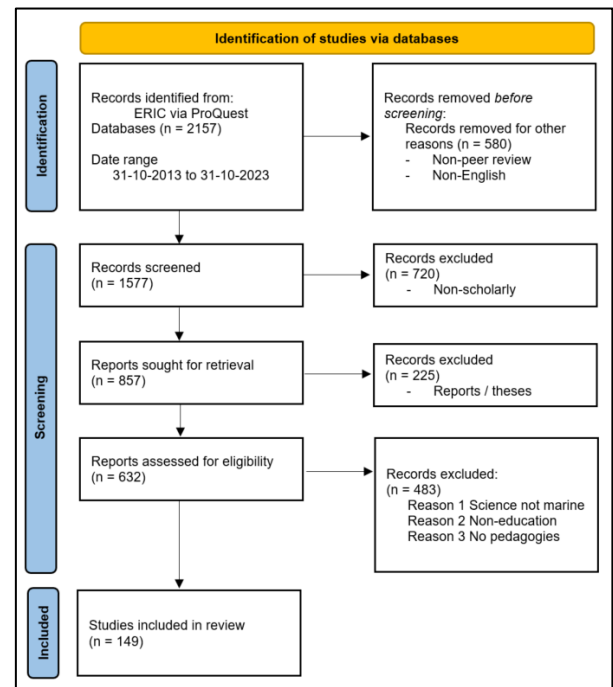


Fig.2. PRISMA Chart

3 Results and Discussion

The rapid review and subsequent coding generated eight themes and one set of recommendations. I outline these below.

Theme 1: Learning potential of marine education

Five key ideas about the learning potential of marine education were found in the literature corpus. In summary, marine education is a worthwhile endeavour if integrated across the curriculum as this prevents it from being seen as another thing to be taught in an overcrowded curriculum. When taught well by a teacher with Ocean Literacy, scientific knowledge, cultural knowledge, indigenous perspectives are learning outcomes.

- Best used as a focal point to develop reading, writing, mathematics etc, problem-solving, critical thinking
- Provides first-hand scientific and cultural experiences
- Leads to informed decision-makers and citizens
- Provides access to indigenous perspectives
- IF the teacher has Ocean Literacy, then s/he can develop Ocean Literacy in students

Theme 2: Knowledge acquisition

Four key knowledge types were reported in the literature corpus. In summary, marine education has been shown to develop a wide array of disciplinary and interdisciplinary knowledge:

- Ecological knowledge
- Mathematical knowledge
- Economics and civics knowledge
- Interdisciplinary knowledge

Theme 3: Skill acquisition

Three skill types were reported in the literature corpus. In summary, marine education has been shown to develop skills related to the marine science discipline and skills used in the Education discipline. These disciplines share specific skills relating to apparatus use and the scientific process.

- Professional skills (workforce related)
- Specific skills
 - Scientific apparatus skills
 - Inquiry process skills
- Generic Skills
 - Collaborative skills (group work)
 - Research skills (locate, organise, convey)
 - Active learning

Theme 4: Attitudinal gains

Four differing types of attitudinal gains types were reported in the literature corpus. In summary, marine education has been shown to impact engagement in academic content, stewardship, and self-confidence to participate in the sciences.

- Intellectual interest (curiosity)
- Awareness and commitment gains
- Interdisciplinary knowledge leads to transdisciplinary attitudes
- Self-confidence

Theme 5: Planning approaches

Five differing planning approaches used by teachers, university academics, and informal education providers (e.g. zoo and aquarium programs) were reported in the literature corpus. In summary, when planning marine science learning experiences, the learner must be considered as well as the content knowledge. Goals and objectives should guide the learning experiences. If a marine environment is not available, acceptable substitutes are creeks and waterways.

- Understand who is being taught
- Clear educational goals and objectives needed
 - Make stewardship explicit
 - Include policy ideas for ALL learners
 - Include restoration activities
- Consideration of learning styles
- Integration is explicit
- Use creeks and waterways as a substitute

Theme 6: Teaching methods

Three differing teaching methods (pedagogy approaches) used by teachers, university academics, and informal education providers were reported in the literature corpus. In summary, the key types appear to be primarily interactive.

- Fieldwork and inquiry processes
- Classroom activities
 - Simulations and taxonomic activities
 - Guest speakers
 - Debating
 - Storybooks
 - Group Problem-based scenarios
 - Digital opportunities

- Teacher centred

Theme 7: Teaching method frequencies

A frequency analysis of the reported teaching methods (pedagogy approaches) used by teachers, university academics, and informal education providers was conducted (see Figure 3). Although the typology in Theme 6 indicates a primarily interactive learning experience is available in marine education, the frequency analysis indicated it is very teacher-centred.

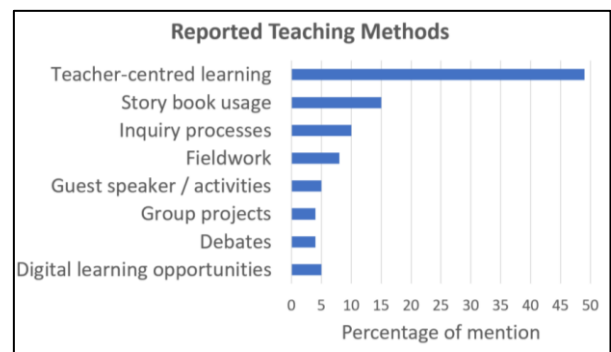


Fig. 3. Frequency of teaching methods

Theme 8: Assessment approach

Six assessment approaches were reported in the literature corpus. In summary, the assessment reported relates to the 21st Century Skills and capabilities. Interestingly, no studies reported an examination focused on assessment.

- Group work skills
- Communication skills
- Curriculum or policy planning (as relevant)
- Research skills
- Critical thinking
- Stewardship participation

Theme 9: Recommendations

Ten recommendations are either explicit or implied in the literature corpus. In summary, hands-on, integrated activities conducted in the field are paramount. Teaching for understanding and stewardship is essential.

- Fieldtrips are essential or substituted with classroom taxonomic activities
- Use of a framework (e.g., 5E's or Engage, Involve, Imagine, Interaction)
- Integration across the curriculum through problem-solving
- Preservice teacher co-plan experiences with classroom teachers IN CONTEXT
- Classroom resources and professional development for teachers
- Education faculty work with Science faculty to develop pedagogical approaches
- Focus on empowering the learner to be a change agent (stewardship)
- Focus on problem identification
- Show all learners the implications of environmental manipulation
- Teach for understanding, not replication

4 Conclusion

As educators, there are several steps we can take to ensure marine education is optimal. At the very least, we need to enable teachers to consider its inclusion in the curriculum as a context for science and humanities lessons. To do this, we need professional development and teaching resources. Education and discipline experts need to develop this support system to show content integration. This will reduce the perception of marine science content as another topic to include in an overcrowded curriculum. The reduction of teacher-led pedagogies is a necessity.

References

1. G. Fauville, C. Strang, M.A Cannady, M.A., & Y-F. Chen,. EER 25(2), 2019
2. M.J. Page, J.E. McKenzie, P.M. Bossuyt, I. Boutron, T.C. Hoffmann, C.D. Mulrow, et al. BMJ 372:n71. 2022