Currachs and Ethnomathematics

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Currachs are traditional boats, made of thin strips of wood, covered in cloth, but their use has declined in Ireland since the 19th century. When traditional practices need reviving or maintaining, ethnomathematics is often promoted as a way to contribute to this in mathematics classrooms. In this paper, we use the cultural symmetry model to examine opportunities and issues that could arise when ethnomathematics is used to explore the building of currachs. We investigate this as a research project, with potential links to what could occur in school. This model enabled us to discuss how the currachs used locally available materials to fulfil specific purposes and to consider how describing them as mathematics could add to understanding their construction. The model also provided opportunities to discuss how the design of currachs and why they are no longer being built in many places can be connected to the valuing of different knowledge over time.

Keywords: ethnomathematics, cultural practices, currach

Introduction

> "Lightweight and constructed of readily available, inexpensive materials, these uniquely Irish craft used scarce wood conservatively, relying instead upon the hides of locally raised livestock, or later upon tarred canvas" (Sikes & Meide, 2006, p. 5).

Currachs (see Figure 1) are traditional Irish boats whose use goes back to pre-history (Tully, 2008) and are present in much of the history of Ireland (Tully, 2008), including a brief possible mention in Tamsin's family history of the Kerin family from Ballyvaughan, in the north of County Claire.

Figure 1

Currach from the Arran Isles with a lob sail (Hornell, 1938)

Note: from Hornell (1938, Plate II).

Yet, since the time that the Kerin family left Ballvaughan in 1866, the building of currachs has almost completely been reduced to being built for races, with their original function as fishing boats, or to ferry goods around the coast, no longer much in evidence. In 2008, in a survey of traditional Irish boats in County Clare, no currachs were registered at Ballyvaughan (Tully, 2008). In County Clare as a whole, there were 70 currachs, of which 38 were of the

West Clare style. Not all of these were in use (Tully, 2008). The Heritage Council (2006) in a policy document noted that modern fishing regulations and safety concerns have led to the decline, which with an ageing population of those who knew how to build them was likely to result in their disappearance in the future.

Education is often advocated as a way to maintain and resurrect cultural practices (Trinick & Meaney, 2020). Yet, the revival of cultural artefacts and knowledge in schools comes with multiple considerations, particularly in countries with histories of colonisation. In mathematics education, ethnomathematics is often used as a basis for integrating a cultural practice or tradition into mathematics lessons in schools.

> Ethnomathematics is a research program incorporating history, anthropology, pedagogy, linguistics, and philosophy of mathematics with pedagogical implications that focus on the techniques of explaining, understanding and coping with different sociocultural environments. (Rosa & Gavarrete, 2017, p. 5)

Ethnomathematics is advocated as a way to engage cultural and/or underachieving groups in school mathematics by including aspects of Indigenous or cultural mathematics that are usually not considered valuable enough to discuss in schools (Meaney et al., 2022; Trinick & Meaney, 2020). For example, Gerdes (1985) identified situations in which mathematical elements existed in the daily life of Indigenous groups during the colonial occupation of Mozambique, but which were not recognised as such because of the colonisers' belief in the superiority of Western mathematics. However, as summarised in Meaney et al. (2022), several concerns have been raised about the inclusion of cultural practices into mathematics education. These concerns focus on how the use of ethnomathematics can result only in the valuing of the cultural practice or artefact as a way to learn Western mathematics. Similarly, discussing the artefact or practice can restrict it to being valued only as a connection to the past, romanticising the artefact or practice, without discussing its value within modern society. This suggests that before introducing currachs into school mathematics, there is a need to describe what an ethnomathematical gaze on currachs could contribute and to consider how the integrity of the cultural artefact could be maintained if it were to be included in school mathematics. Thus, our research question is: What opportunities and issues are raised when considering the ethnomathematics of currachs in educational situations?

To answer this question, we frame our investigation by using the cultural symmetry model Meaney et al. (2022). This model identifies the aspects—social, linguistic, cultural (knowledge and values), and mathematical—which affect the choice to use cultural artefacts or practices in the classroom. We begin by describing the curricular opportunities that could be connected to ethnomathematics, before briefly describing the cultural symmetry model.

Curricular Opportunities

The Irish post-primary (approx. age 12-18) education system operates on a centralised education model and contains very prescriptive syllabi, with a state examination after year three and a terminal state examination upon completion of post-primary education. These relate to the Junior Cycle (Years 1- 3) and Senior Cycle (Years 5 and 6), respectively. The

introduction of a new mathematics curriculum in 2010 aimed to address issues relating to students' understanding of mathematical concepts, their ability to apply and problem solve, and to move away from over reliance on rote-learning procedures (Shiel & Kelleher, 2017). There was an emphasis on setting mathematics in context and making it relevant for learners. The reform involved a staggered rollout of the new specification over the course of five years with changes to the content of the syllabi, how mathematics is taught and how it is assessed, with some further revision in 2018. In the current Junior Cycle mathematics specification (National Council for Curriculum and Assessment/Department of Education and Skills [NCCA/DES], 2017, p. 5), mathematical proficiency is conceptualised not as a one-dimensional trait but as having five interconnected and interwoven components:

- conceptual understanding—comprehension of mathematical concepts, operations, and relations
- procedural fluency—skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- strategic competence—ability to formulate, represent, and solve mathematical problems in both familiar and unfamiliar contexts
- adaptive reasoning—capacity for logical thought, reflection, explanation, justification and communication
- productive disposition—habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence, perseverance and one's own efficacy.

There is limited research which has examined the impact of the 2010 curriculum. Shiel and Kelleher (2017) concluded that it has had a small positive impact on performance, teaching approaches and students' attitudes. The Junior Cycle specification acknowledges that mathematics and mathematical ideas have evolved across societies and cultures over many years. While the move to utilising contexts and real-life problems to teach mathematical concepts is worthwhile, we suggest that ethnomathematics may provide another such possibility and could be incorporated into current curricular offerings to embed more strongly the role of culture and society. In particular, the current use of contexts by Irish mathematics teachers generally examines the mathematical concept. However, adopting an ethnomathematical approach could build on this and explore ideas such as social values and cultural roots and their connection to mathematics (Rosa & Gavarrete, 2017), while enabling the five interconnected components outlined above. Transition Year (TY, optional year between the Junior and Senior Cycles) could provide such an opportunity. TY is designed to be cross-curricular in nature and affords teachers the scope to plan learning experiences outside of the prescribed curricula. Adopting an ethnomathematical approach in TY may provide students with an opportunity to revisit their mathematical understandings, while developing an appreciation of diversity and cultures. It could also support a way to examine traditional artefacts and practices as contexts for learning mathematics.

The Cultural Symmetry Model

The cultural symmetry model was developed as part of a long-term project about the revival and maintenance of Māori language and culture through mathematics in

Aotearoa/New Zealand. It consists of three steps to cover different aspects that need consideration when integrating a cultural artefact or practice into mathematics education (Meaney et al., 2022). The cultural symmetry model was designed to find a balance between Indigenous cultural knowledge, including language, and mathematical cultural knowledge.

The first step is to identify why a group values the practices and artefacts, as a contribution to a local or societal cultural tradition. In regard to Indigenous cultural traditions, this is usually best done in collaboration with elders, who have expertise in regard to the practices and artefacts. This focus enables the revitalisation and maintenance of the cultural knowledge to occur through understandings about the original purposes of the practice and artefact. Ideally, the traditional language should be used to discuss this cultural knowledge. However, in some situations of colonisation, Indigenous languages have been lost or are in the process of being revived. In these cases, the choice of language needs consideration.

The second step involves examining the cultural artefact or practice from a range of perspectives, of which mathematics would be one. Different knowledge bases can deepen understandings about the practices and artefacts. Mathematics provides one way to describe the cultural artefact or practice. An outcome of this step is to illustrate how invisible socio-cultural aspects connected to a practice, such as cultural values, relationships, problem solving processes and knowledge can be ignored, when an artefact or practice is just viewed as a quaint, historical relic. By discussing the practice or artefact from a range of perspectives, students' language can be developed. This is particularly important when the students are second language learners of the language being used in the classroom.

The third step involves discussing how and why different kinds of knowledge are valued by different groups of people at specific periods of time, sometimes to the detriment of other groups. This provides an opportunity to raise how mathematical discussions about a cultural artefact or practices should not detract from cultural understandings.

Currachs and the Cultural Symmetry Model

In this section, we discuss each step of the cultural symmetry model and identify opportunities and issues that need consideration in using the design and building of a currach as a possible focus for mathematics education in schools. We use information about the currachs from County Clare, predominantly, but also draw on information about currachs from other areas. Information about currachs comes from several written sources, in particular Hornell's (1938) definitive article on the "The curraghs of Ireland", as well as films about currachs, available on YouTube, some of which provide audio-commentary, with many showing the building of currachs at different points in time. Our lack of experience of being in a currach means that we are restricted to being observers. Thus, rather than focus on their functions at sea, we investigate the ethnomathematics of designing and building currachs.

Step 1: The Cultural Tradition

Currachs were a product of their environment in that local resources were used in their design and building so that they could fulfil particular purposes such as fishing or ferrying

items around the coast. Although currachs made of a tied frame of willow or hazel and covered with animal hide were used from prehistoric times in inland waterways of Ireland, changes in design and function occurred in the 1820-1830s (O'Sullivan & Downey, 2015). These changes produced the fishing currachs of the west coast of Ireland which were built using sawn timber in the hull, a double gunwale and tar covered cloth. In County Clare as elsewhere along the west coast, trees were scarce and only the frames were made of wood:

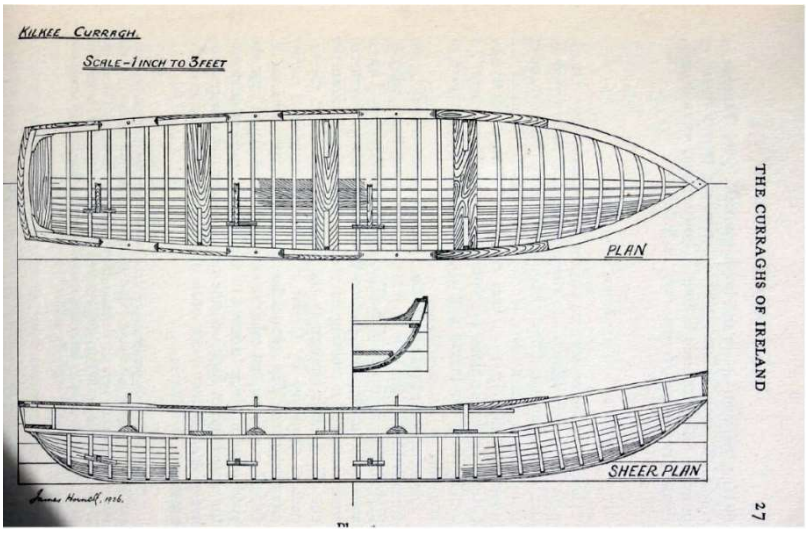
> Deal was used for the oars and gunwale (upper edge of the side of the currach). Oak was used for the frame, while elm and sallywood were also used in currach construction. Although a finished currach could reach up to 18 feet in length, be up to 4 feet wide and 3 feet deep, these vessels are remarkably light and manoeuvrable and could be easily beached. (The Clare Champion, 2002, p. 1).

Thus, the function of the boats was to be able to tackle the seas around the coast and to beach on the shoreline, not always an easy task. This could be achieved through using lightweight materials. However, the design of a currach differed according to locality. These differences seemed to be due to whether the currach was to be paddled or rowed; the sea conditions; and what the currachs were to transport (O'Sullivan & Downey, 2015; Tully, 2008). There were also differences depending upon the number of rowers. In more recent times, the use of currachs for racing have affected their design (Tully, 2008).

Nevertheless, a commonality between currachs which is different to most other boats is that they are built from the top. Figure 2 provides a conventional plan of a currach which shows the boat as though it was sitting on the water.

Figure 2

Kilkee currach



Note: from Hornell (1938, p. 27).

Yet, currachs are built from the double gunwale upwards, with the ribs being bent, usually after being steamed, and placed directly into the gunwale. This makes visualising the design "upside down" difficult, as noted by Shane Holland in Broderick's (2018) film on the *Currach Na Sceiri* (Skerries Currach), by those familiar with building other kinds of boats.

Valuing of the design and building of currachs needs to be done first from the perspective of its role for a cultural group. This situates the currach, not as a vehicle for developing mathematical understandings, but as having value within a cultural group for the function that it fulfils. Nevertheless, the discussion of the design and building of currachs provides some opportunities to highlight mathematical ideas, which are described in the next sections. There is a need to consider which language should be used to discuss currachs, depending on general fluency of teachers and students as well as specific fluency with boat building terms.

In the mathematics lessons, a tension could arise with expectations about fulfilling a highly prescriptive curriculum when so much time needs to be spent on discussing the cultural aspects of the artefact, before discussing any mathematics. However, if everyday situations are to be used to support students to see mathematics as useful, then time needs to be spent discussing those everyday activities as being meaningful in their own right.

Step 2: Currachs from Multiple Perspectives

The design and building of currachs can be discussed in many ways, related to the resources available, the traditions for building at a particular moment in time and the purpose that the currachs were supposed to fulfil. The changes can be discussed in relationship to the historical context. For example, the change to tarred cloth became an alternative to the use of animal hides, with the coming of the industrial revolution and the production of cotton that allowed the import of cheap canvas. Similarly, the design of currachs could be discussed in relation to the sea conditions and possibilities for landing a boat on the shoreline of the Atlantic Coast. Such discussions provide possibilities to make visible socio-cultural aspects connected to currachs, such as cultural values, relationships, problem solving processes and knowledge. They also allow for vocabulary and grammar enrichment for students who have not had previous experiences with boats or discussing boats in a particular language.

In these discussions, there are possibilities to make connections to strategic competency, adaptive reasoning and productive dispositions, from the Junior Cycle mathematics specification (NCCA/DES, 2017). For example, the measurements in the designs, including the scales in the plans (see Figure 2), provide opportunities for currachs to be discussed mathematically. Measurements provide opportunities to discuss differences between currach designs and reflect on how those differences might be affected by the environment and the resources available. For example, the shape of the bow provides opportunities to discuss different angles and mathematical functions (for example the sheer plan in Figure 2) but these discussions need to add value by extending the discussions about how the bow shape is affected by the sea conditions faced by those rowing the currachs.

As well, there are opportunities to discuss visual-spatial skills linked to being able to have a mental map of the currach to ensure that all pieces are cut and placed appropriately to ensure the efficient building of the boat. Mathematics contributes to discussions about the design and building of currachs, rather than the design and building of currachs being the vehicle for discussing mathematics. Mathematics needs to add value to these discussions,

rather than detract from them, otherwise mathematics will not be seen as sensible, useful, and worthwhile, as designated by the Junior Cycle specification (NCCA/DES, 2017).

However, issues can arise in classrooms if the students do not have sufficient knowledge about the artefact or practice, or the valued knowledge about that cultural practice or artefact. Without this, a focus of mathematical understanding can be seen as disrespectful in that it questions cultural knowledge. This was the case in the study of traditional wayfaring in the Pacific in a study by Trinick and Meaney (2020). Consequently, there is a need to discuss who can decide which knowledge is valuable and in what circumstances. This provides a critical perspective on the valuing of some knowledge, such as mathematics, and how this might affect the valuing of other knowledge.

Step 3: Adding Value with Mathematics and Discussing the Politics of Valuing Knowledge

By discussing currachs from a mathematical perspective it is also possible to discuss how different knowledge systems come to be valued. For example, who decides whether a design is "upside-down"? Such a determination indicates that there is a general expectation about what is the "normal" way of building boats. Rarely in mathematics lessons is space given to discussions about who decides what kind of knowledge is valued in classrooms and in examinations and how valuing one kind of knowledge may affect how other knowledge is valued. This lack is in contrast to statements in curricula, such as the Junior Cycle specification, which acknowledge that mathematics and mathematical ideas have evolved across societies and cultures over many years. Yet, for example, discussions about visualising the design of currachs which deepen understanding about shapes and how they are described using algebraic notation, bring together geometric as well as algebraic understandings, two different kinds of knowledge, not easily developed otherwise. Therefore, although taking time in a mathematics lesson, discussions about valuing different kinds of knowledge can highlight how mathematics can be developed in the future, through connections to everyday situations.

Conclusion

Our aim was to consider the opportunities and issues that arise if ethnomathematics is to be used in bringing a cultural artefact or practice into mathematics classrooms. In particular, we looked at how the design and building of currachs could promote discussions about different kinds of knowledge, including mathematical knowledge, and how this could contribute to mathematics being seen as sensible, useful, and worthwhile as required by the Junior Cycle mathematics specification (NCCA/DES, 2017). Thus, ethnomathematics, through discussions about currachs, provides opportunities to deepen students' understandings about mathematics, but also about how mathematics comes to overtake the importance of other cultural knowledge unless precautions are implemented and discussed.

However, in a prescriptive curriculum, mathematics teachers may struggle to find the time to raise discussions about how different aspects of knowledge come to be valued, especially if such discussions are not recognised in examinations. There is also a need to consider whether the currach is best revived as a meaningful cultural artefact, through discussions within a mathematics classroom. It may instead need better opportunities for

cross-subject integration of projects that involve language, craft and mathematics. Such decisions cannot be made at the teacher level, but require the education system more generally to decide how the aims of the curriculum regarding the use of every day and cultural experiences can be integrated more appropriately in schools.

References

Broderick, M. (2018, September 27). *Currach Na Sceiri (Skerries Currach)* [Video]. YouTube. https://www.youtube.com/watch?v=4JTogT2G1Ww

Gerdes, P. (1985). Conditions and strategies for emancipatory mathematics education in undeveloped countries. *For the Learning of Mathematics*, *5*(1), 15-20.

Hornell, J. (1938). The curraghs of Ireland. *The Mariner's Mirror*, *24*(1), 5-39.

Meaney, T., Trinick, T., & Allen, P. (2022). Ethnomathematics in education: The need for cultural symmetry. In M. Danesi (Ed.), *Handbook of Cognitive Mathematics* (pp. 191-219). Springer. https://doi.org/10.1007/978-3-030-44982-7_4-1

National Council for Curriculum and Assessment/Department of Education and Skills [NCCA/DES] (2017). *Junior Cycle Mathematics*. Government of Ireland. https://www.jct.ie/perch/resources/maths/junior-cycle-mathematics-specification-2018.pdf

O'Sullivan, M., & Downey, L. (2015). Currachs. *Archeology of Ireland*, *29*(1), 39-42.

Rosa, M., & Gavarrete, M. E. (2017). An ethnomathematics overview: An introduction. In M. Rosa, L. Shirley, M. E. Gavarrete, & W. V. Alangui (Eds.), *Ethnomathematics and its diverse approaches for mathematics education* (pp. 3–19). Springer. https://doi.org/10.1007/978-3-319-59220-6_1

Shiel, G., & Kelleher, C. (2017). *An evaluation of the impact of Project Maths on the performance of students in Junior Cycle mathematics*. Educational Research Centre.

Sikes, K., & Meide, C. (2006). *British imperialism on Achill Island, Ireland: A study of Irish symbolic resistance through the use of vernacular fishing boats*. Paper presented at the American Society for Ethnohistory Annual Conference, 2 November 2006, Williamsburg, Virginia.

The Clare Champion. (2002, August 30). *The riches of Clare: The Clare currach* Clare County Museum. https://www.clarelibrary.ie/eolas/claremuseum/news_events/ccclare_currach.htm

The Heritage Council (2006). *Conserving Ireland's maritime heritage*. An Chomhairle Oidhreachta/The Heritage Council.

Trinick, T., & Meaney, T. (2020). Ethnomathematics and Indigenous teacher education: Waka migrations. *Revemop*, *2*(1-18). https://hdl.handle.net/11250/2718993

Tully, D. (2008). *Clare Traditional Boats and Currach Project 2008*. Clare County Council.