

Competency Alignment Between the Fisheries Science Curriculum and Industry Requirements: Perspectives of Fisheries Educators

Jomark DV. Parana¹, Danilo G. Soriano, Jr.², Cynthia P. Lopez³

Lyceum Northwestern University¹

Department of Education²

jparana6086@dmmmsu.edu.ph/ parana.jomark.d@lyceum.edu.ph

Abstract

The fisheries industry is undergoing rapid transformation driven by innovations, environmental changes, and evolving workforce demands, requiring Higher Education Institutions (HEIs) to continuously evaluate curriculum relevance. This study explored the alignment between the Bachelor of Science in Fisheries curriculum and industry competency requirements from the perspectives of fisheries educators in selected HEIs across Luzon, Visayas, and Mindanao, Philippines. The study used a qualitative phenomenological research design with a purposive sampling approach. Data were gathered through open-ended questionnaires and interviews with deans and program chairpersons and analyzed using thematic analysis. Results revealed that there is existing alignment between the Bachelor of Science in Fisheries curriculum and the competency needs of the fisheries industry, particularly the core competencies in aquaculture, capture fisheries, fisheries management, post-harvest technology, fisheries extension, and fisheries laws. However, the alignment is only partial due to gaps related to experiential learning; the inclusion of new competencies such as climate change adaptation, sustainability, digital technologies, international standards, entrepreneurship education, and localization of course content in terms of the regional fisheries system; and the need for further integration of these competencies into the curriculum. The research study finds that the continuous development of the curriculum, close collaboration with the industries, betterment of training facilities, and regular review of the curriculum are vital to ensure workforce relevance and prepare Fisheries graduates to become adaptive, innovative, and globally competitive professionals capable of supporting sustainable fisheries development and the Philippine blue economy.

Keywords: Fisheries education, curriculum alignment, competency-based education, fisheries curriculum, higher education

INTRODUCTION

Fisheries continue to be central to food security, economic development, employment creation, and environmental sustainability throughout the globe. The fisheries industry supports a huge number of jobs and provides one of the main sources of animal protein for billions of people around the world. Other than its economic significance, fisheries support coastal communities, rural livelihoods, international trade, and have made substantial contributions to the realization of some of the Sustainable Development Goals, such as SDG 2 (Zero Hunger),

SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 14 (Life Below Water). The fisheries industry, however, faces many challenges arising from climate change, overexploitation of aquatic resources, habitat degradation, rapid technological developments, market globalization, and increasingly complex governance regimes (Hakan, 2021; Oracion et al., 2020; Yadaya, 2000).

These trends have greatly changed the way fisheries work. The present-day fisheries professionals are expected to be competent in domains other than those traditionally associated with biological and production sciences. The modern workforce needs knowledge of digital technology, ecosystem-based fisheries management, climate change adaptation, aquaculture innovation, resource economics, food safety, value chain development, policy analysis, entrepreneurship, communication, leadership, and problem-solving through an interdisciplinary approach. As a result, fisheries education has moved from content-oriented training to competency-based education (Gervais, 2016; Gills et al., 2023; Sajesh et al., 2021).

Competency-based education has emerged as a useful strategy for enhancing graduates' preparedness to work because curricula have learning outcomes directly related to workplace requirements. Unlike conventional curriculum design models, which focused mainly on knowledge development, competency-based learning emphasizes authentic learning opportunities, performance-based assessment, and workplace application of skills to create graduates who can solve practical problems at work. Consequently, the effectiveness of curricula offered by higher education institutions is evaluated by not only academic quality but also their relevance to labor market trends (Gervais, 2016; UNESCO, 2020).

Over the last two decades, the fisheries sector has witnessed significant changes in response to technological developments, environmental shifts, and globalization. Innovations in terms of mechanization, electronic navigation technologies, artificial intelligence, remote sensing, geographical information system, precision aquaculture, molecular diagnostics, seafood traceability, and data-based fisheries management have defined the new competencies needed by the workforce. Employers have thus become increasingly interested in individuals who possess both discipline-specific knowledge and transferable competencies, including communication skills, leadership, critical thinking, digital competencies, project management, adaptability, and entrepreneurial mindset (Sajesh et al., 2021; Glenn et al., 2025; Gills et al., 2023).

Despite these advancements, many studies point to a recurring gap between higher education and workforce requirements in fisheries-related disciplines. According to evidence from Asia, although the students may have a reasonable level of theoretical knowledge, they lack practical skills, especially regarding new technology, working environment, sustainability practices, business management, innovation, and effective communication. Similarly, employers have always complained about the lack of workplace readiness, technological adaptation, and interdisciplinary skills, which is why curriculum development needs to be done based on

competencies with enhanced industry-higher education cooperation (Ahmadi et al., 2011; Gills et al., 2023; Glenn et al., 2025; Sajesh et al., 2021).

In Southeast Asia, fisheries human resource development has always been regarded as an essential element for sustainable fisheries management and food security in the region. A study carried out by the Southeast Asian Fisheries Development Center (SEAFDEC) indicates significant gaps in knowledge about fisheries biology, aquaculture, fisheries management, post-harvest technology, fisheries legislation, climate adaptation, and other new areas of interdisciplinary studies. The study also indicates the need for developing competencies through higher education programs to cope with technological developments, environmental changes, international standards, and complexities in fisheries governance (Ahmadi et al., 2011).

These problems have greatly affected the Philippine fisheries sector. Even if the fisheries sector still contributes significantly to the country's food security and economic development, the reduction in capture fisheries, environmental deterioration, IUU fishing, impacts of climate change, limitations in governance, and changes in labor market requirements still pose a great challenge to the sustainability of the sector (Baclig, 2026; Hakan, 2021; Oracion et al., 2020). Solving such issues requires an able workforce that can combine science, technology, the environment, policies, and communities. Thus, HEIs that offer the BS Fisheries program are greatly essential in ensuring that graduates will have the necessary skills for these kinds of challenges.

Nonetheless, research shows that curriculum responsiveness continues to be an issue in fisheries education in the Philippines. From tracer surveys conducted among Fisheries graduates, a significant number of graduates tend to work in non-fisheries-related occupations, while employers still identify weaknesses in graduates' competencies in technical applications, communication, leadership, innovation, information technology, and problem-solving. These findings point out that while there are already strong disciplinary frameworks for Fisheries Science courses, there is still room for improvement through the development of competency-based curricula as well as collaboration with the industries (Gills et al., 2023; Rosaldo, 2024).

Furthermore, recent deliberations regarding the governance of fisheries reinforce that sustainable fisheries development cannot happen without good policies and innovations, but also requires competent individuals who can convert scientific knowledge into practical management in the industry. With the increasing multidisciplinary aspect of fisheries systems, universities should regularly review their curricula and assess whether they can meet up-to-date occupational demands, innovations, sustainability practices, and workforce needs (Oracion et al., 2020; Orofino et al., 2023; Sajesh et al., 2021).

Although there has been an increase in the use of competency-based education and workforce preparation, empirical studies that have sought to determine the degree to which

Fisheries Science curricula are aligned with industry competencies in Philippine Higher Education Institutions are rare. Most studies have dealt with graduate employability, tracer studies, or curriculum evaluation, without paying much attention to identifying competency gaps as perceived by people directly involved in curriculum delivery. It is crucial to understand how educators perceive the issue since they play key roles in curriculum planning, delivery, and assessment, as well as quality improvement. This would provide useful information on ways of enhancing the curriculum and its development through competencies.

Therefore, this study explored the alignment between the current Bachelor of Science in Fisheries curriculum and the competency requirements of the fisheries industry from the perspectives of fisheries educators in selected Philippine Higher Education Institutions. Specifically, the study sought to identify gaps in the curriculum, perceptions of fisheries educators about graduates' readiness for the industry, and generate information for enhancing a competencies-based curriculum.

METHODS

Research design

This study employed a qualitative phenomenological research design to explore the alignment between the current Bachelor of Science in Fisheries curriculum in Philippine Higher Education Institutions (HEIs) and the competency requirements of the fisheries industry from the perspectives of fisheries educators. The reason for using phenomenology as the method was the opportunity to gain deeper insight into the perceptions and experiences of the participating educators concerning curricula and competencies.

Participants and Sampling

The participants consisted exclusively of fisheries educators from selected Higher Education Institutions offering the Bachelor of Science in Fisheries program across Luzon, Visayas, and Mindanao, Philippines (Table 1). In particular, the participants included deans and chairpersons of the program from different colleges, who have been actively engaged in curriculum planning, implementation, evaluation, and quality assurance.

Table 1. Profile of the participants

Participant	Age	Sex	Designation/Position	Years of Deanship or Chairmanship
1	39	Female	College Dean	3
2	40	Female	College Dean	3
3	42	Male	College Dean	3
4	39	Female	College Dean	more than 10
5	34	Female	College Dean & Program Chair	1
6	42	Male	College Dean	3

7

34

Male

Program Chair

3

Participants were selected through purposive sampling using predetermined inclusion criteria. Eligible participants had to be working in a Fisheries program either as educators or administrators; they should have considerable experience in teaching or implementing the curriculum, and they must be willing to join the research. Purposive sampling ensured that participants could share pertinent information about curriculum implementation and competency development, as they have the necessary professional and academic background. Sampling was terminated when thematic saturation occurred, meaning no more new themes could emerge from the subsequent interviews.

The present research concentrated on fisheries educators since they are an integral part of curriculum planning, implementation, evaluation, and quality improvement in HEIs. Industry competencies were used as the benchmark in evaluating curriculum relevance, but they were interpreted through the eyes of the educators and not through the actual involvement of the industry experts.

Instrument

The researcher served as the primary research instrument in gathering and interpreting the qualitative data. Data collection was conducted through an interview guide developed by the researcher with open-ended questions intended to gain insights about participants' perspectives regarding curriculum relevance, competency development, workforce preparedness, existing curriculum gaps, and recommendations for curriculum enhancement. The interview guide was developed in line with the study objectives and the literature on competency-based education in fisheries.

Data collection

Prior to data collection, the necessary institutional permissions were secured, and informed consent was obtained from all participants. Data were collected through asynchronous online open-ended questionnaires followed by in-depth interviews conducted either face-to-face or through online conferencing platforms, depending on the participants' location and availability. The interviews took between 45 and 90 minutes and were audio-recorded with participants' permission.

Field notes were maintained throughout the interviews to document contextual observations, emerging insights, and the researcher's reflections that complemented the interview transcripts. All interviews were transcribed verbatim to preserve the accuracy and completeness of the participants' responses. To enhance the credibility of the findings, member checking was conducted by providing selected participants with summaries of the interpreted data for verification and confirmation.

Data analysis

The interviews were recorded and manually analyzed using Microsoft Word and NVivo 12 software. Thematic analysis was performed according to Braun & Clarke's (2006, 2021) six-step approach, including data familiarization, coding, categorizing, and theme generation to uncover the viewpoints of the fisheries educators concerning curriculum relevance and competency match.

Artificial intelligence (AI) technology was applied exclusively for checking grammatical mistakes, language polishing, formatting, and paraphrasing to improve manuscript readability. All interpretations, analysis, and conclusions were performed solely by the researcher.

Trustworthiness of the study was ensured using the four criteria developed by Lincoln & Guba (1985), namely credibility, transferability, dependability, and confirmability. Credibility was achieved through member checking, transferability through the provision of contextual information, dependability through the recording of all research procedures, and confirmability through reflective memo writing.

RESULTS

The results indicate the present curriculum for Bachelor of Science in Fisheries is aligned with the necessary competency standards in the Philippine fisheries industry. Across the participating Higher Education Institutions (HEIs), fisheries educators acknowledged that the curriculum offers students an excellent background in aquaculture, capture fisheries, fisheries management, post-harvest technology, fisheries laws, and fisheries extension. The core competencies mentioned by the participants give the graduates the capacity to engage in various work environments like government offices, private companies, research facilities, and community-based fisheries groups.

Participant 6 emphasized that the curriculum is purposefully made to develop fisheries practitioners who will ensure the sustainable development of the fisheries industry while enhancing the welfare of the fishing communities.

"The current curriculum is industry-need-driven... geared to lead as stewards of existing fisheries resources, help alleviate the lives of marginalized fisherfolk, and boost fish production through sustainable aquaculture development." —Participant 6

Similarly, Participant 3 observed that the curriculum has become increasingly sustainable and technologically innovative, as well as socially engaging, considering the needs of the fisheries sector have changed.

"The current fisheries curriculum... exhibits notable alignment with the evolving needs of the fisheries sector, encompassing small-scale fisheries, aquaculture, and marine conservation." —Participant 3

Furthermore, Participant 5 added that curriculum updates are constantly informed by consultations with various agencies, including the government, industry organizations, local government units, alumni, and non-government organizations (NGOs).

"We ensure that our curriculum aligns with the needs of the fisheries industry through consultations with fisheries stakeholders." —Participant 5

These findings demonstrate that the current curriculum is firmly based on the subject matter and makes persistent efforts to ensure its relevance by working with stakeholders. Nevertheless, participants consistently acknowledged that the current alignment is still far from complete and that certain competencies should be further developed in response to the changing requirements of the fisheries profession.

Need for Greater Industry-Based and Experiential Learning

A dominant theme that emerged from the interviews was the need to strengthen industry-based and experiential learning. Although participants agreed that theoretical instruction is adequately delivered, they emphasized that opportunities for practical competency development remain constrained by institutional limitations.

The lack of proper laboratories, hatchery facilities, fish processing centers, and modern equipment was among the key factors cited by most participants as the main reason why competences could not be developed properly. Consequently, many institutions rely heavily on external partner agencies and industries to provide students with authentic workplace experiences.

"Even though a hatchery facility has not yet been established, we make sure students are sent to partner institutions...so they acquire the competencies required by the industry." —Participant 1

"Students are trained through lectures and hands-on activities, though these may not be enough due to limitations in equipment and facilities." —Participant 5

Participant 7 similarly acknowledged:

"The challenge is the actual skills in fish processing since the facility is not designed as an HACCP fish processing facility." —Participant 7

This implies that, though experiential learning is crucial in acquiring skills, there are differences in how this concept is implemented, depending on the resources available in different institutions. As a result, skill acquisition or the competencies is usually an outcome of collaboration from outside the organization.

Emerging Industry Competencies Are Not Yet Fully Integrated

While participants acknowledged that topics like adaptation to climate change, sustainability, and fishery laws are included in the syllabus, they believe that competency in such areas needs more elaboration and application.

"Climate change adaptation and sustainable fishing practices are not sufficiently covered, unlike post-harvest technologies." — Participant 4

"Climate change adaptation is mostly theoretical... more hands-on learning, local case studies, and innovation tailored to small-scale fisheries are needed." — Participant 3

Beyond sustainability, several participants highlighted the increasing importance of international seafood standards and global regulatory compliance.

"More training on international standards like seafood export regulations is needed." — Participant 3

"It is the need of the time to comply with international regulations and standards." — Participant 6

These findings suggest that while the curriculum takes into account the evolving challenges in the fisheries industry, there is a need for greater emphasis on skills development in areas such as sustainability, adapting to climate change, technological advancements, and international quality standards in order to make graduates job-ready.

Entrepreneurial Competencies Require Further Enhancement

Entrepreneurship emerged as another competency area requiring further improvement. Although entrepreneurship courses are included in the curriculum, participants generally perceived that these courses focus primarily on product development rather than enterprise creation, business management, and innovation.

Participant 2 explained:

"We must not only train BS Fisheries graduates to become scientists but also business owners." — Participant 2

Similarly, Participant 3 suggested the need to develop greater partnerships with fishing co-operatives and increased business incubation to offer real-world entrepreneurship to students.

Also, Participant 1 pointed out the fact that while extension services may already allow students to participate in livelihood programs in the communities, this can be further improved to foster sustainable enterprise development.

Generally, these results indicate the need for entrepreneurship education to go beyond focusing merely on technical aspects such as product development to include enterprise management, value chain development, marketing, financial literacy, and innovation to better prepare graduates for self-employment and leadership within the fisheries industry.

Greater Localization of Curriculum Content

The final theme emphasized the necessity for additional contextualization of the Fisheries education curriculum in line with the different fisheries systems existing within the Philippines. It was noted repeatedly throughout the interviews that there were significant differences in aquatic resources, production systems, ecological conditions, and cultural practices that had to be addressed in curriculum implementation.

"Region-specific fisheries practices should definitely be included because each region has distinct commodities, ecological conditions, and cultural practices." — Participant 1

Participant 3 similarly explained that *"integrating region-specific industries such as seaweed farming, mud crab culture, and milkfish production would improve graduates' relevance to local fisheries communities."*

Participant 4 also highlighted that the expertise available through BFAR Regional Training Centers and Niche Centers in the Regions for Research and Development (NICER) projects could further enrich curriculum implementation by exposing students to regionally significant fisheries innovations.

These results indicate that greater localization of curriculum content will improve the relevance of Fisheries education because the students will acquire competencies that are responsive to the ecological, economic, and cultural environment of their respective regions without deviating from national competency levels.

DISCUSSION

The findings demonstrate that the Bachelor of Science in Fisheries curriculum in Philippine Higher Education Institutions is generally aligned with the competency requirements of the fisheries sector. Fisheries educators consistently identified that the curriculum provides fundamental competencies in areas such as aquaculture, capture fisheries, fisheries management, post-harvest technology, fisheries extension, and fisheries laws. These competencies enable graduates to have the scientific knowledge and technical competence for employment in government agencies, the private sector, research organizations, and community-based fishery organizations. It can be inferred from the results that the use of outcomes-based education and curriculum development based on stakeholder perspectives helped maintain the relevance of fisheries education to the developing fisheries industry in the country.

Even if there is competency alignment in general, the study also shows that competency alignment is dynamic rather than static. Participants consistently pointed out that the rapidly changing nature of the fisheries industry necessitates continual curriculum enhancement to meet new competency requirements. Specifically, they pointed out that it is important to develop new competencies in areas such as digital technologies, climate change adaptation, sustainability, innovation, and entrepreneurship.

These findings are consistent with previous studies reporting persistent gaps between higher education and workforce requirements within fisheries education. International evidence suggests that fisheries education should extend beyond knowledge acquisition toward competency-based learning that develops technical, managerial, entrepreneurial, and adaptive competencies required in modern fisheries systems (Gills et al., 2024; Glenn et al., 2025; Sajesh et al., 2021; Yadava, 2000). Similarly, Rosaldo (2024) found that while Fisheries graduates in the Philippines are considered to have good employability attributes, employers still find gaps in communication, technical skills, problem-solving, leadership, and entrepreneurship competencies. Collectively, these studies reinforce the need for regular curriculum evaluation to ensure sustained alignment with evolving labor market needs.

Another important finding of the study is the significance of experiential and industry learning in competencies development. Although theoretical teaching was considered sufficient, the lack of laboratory facilities, hatcheries, fish processing facilities, and up-to-date learning equipment constrained students from acquiring industry-specific competencies. Hence, many institutions had to depend on collaboration with government departments and private industries to facilitate practical experience for their students. Although these collaborations partially solve the problem of limited resources in some institutions, they also cause variability in students' practical experience across institutions. Such findings were supported by Yadava (2000) and Ahmadi et al. (2011). According to both sources, internships, industry immersion, and practical field-based learning were integral aspects of fisheries education since they help close the gap between theoretical teaching and professional work. Edge (2016) also emphasized the importance of practical learning as an approach to enhancing technical competencies and employability.

The results further highlight the need to strengthen competencies related to sustainability, fisheries governance, and emerging technologies. While these subjects have been included in the curriculum, participants noted that the teaching is quite theoretical in nature and needs more emphasis on practicality. This result indicates the changing and complex problems faced by the fisheries sector in the Philippines, which include the decrease in fish populations, climate change, illegal fishing, environmental destruction, and governance problems, among others, which demand people who can combine science and management based on evidence (Baclig, 2026; Hakan, 2021; Oracion et al., 2020). Furthermore, technological advancements like digital vessel monitoring systems, geographic information systems, remote sensing technology, and fisheries transparency technology continue to shape fisheries management, creating new competency

requirements that higher education institutions must incorporate into curriculum development (Orofino et al., 2023).

Entrepreneurship was also identified as an essential field that would require improvement in the curriculum. While entrepreneurship courses are already present in the BS Fisheries curriculum, respondents pointed out that learning should go beyond product development and venture into enterprise management, business planning, innovation, fisheries cooperatives, marketing, and value chain development. This finding is congruent with findings in previous studies, which highlight how entrepreneurship skills have gained importance, given that fisheries graduates are not only expected to find jobs but also to create ventures and livelihoods (Candano, 2025; Rosaldo, 2024; Sajesh et al., 2021). Strengthening entrepreneurship education therefore has the potential to improve graduate employability while supporting the long-term sustainability of fisheries-based enterprises and coastal communities.

Another notable finding is the call for enhanced curriculum localization. The participants pointed out that by incorporating regionally specific fisheries products, systems, environment, knowledge, and fishery practices, the relevance of fisheries education in the context of the country's various fisheries systems will be heightened. This will allow better integration of teaching, research, and extension while allowing graduates to acquire skills based on the demands of the local industry. This finding reinforces existing research from the Philippines and other countries that have shown the efficacy of localizing and community-sensitive fisheries education in increasing graduates' capability (Ahmadi et al., 2011; Gerona & Betito, 2025; Yadava, 2000).

In summary, the findings show that the existing curriculum for the Bachelor of Science in Fisheries ensures a strong disciplinary background; however, it needs constant upgrading to ensure competence alignment with the dynamically changing fisheries industry. The integration of experiential learning, modern technologies, sustainability competencies, entrepreneurship education, and curriculum adjustments aligned with the region's fisheries system will make students highly adaptable and innovative fisheries professionals who are ready to work in a globalized world.

CONCLUSION

The study concluded that there was significant alignment between the BS Fisheries curriculum and the competencies needed by the fisheries industry, allowing the students to be equipped with enough knowledge and competence. However, there is limited alignment and many areas that need further development in response to industry demands. The fisheries industry highlighted the need to develop experiential learning, incorporate new competencies such as climate change adaptation and sustainability, digital technology and global standards, entrepreneurship education, and contextualize the curriculum to the fisheries system in the region.

It is clear that curriculum enhancement should always be an ongoing process of engaging with industry and training facilities, and conducting curriculum evaluation from time to time. This would ensure that the future Fisheries graduates become competent, adaptable, and globally competitive professionals.

Acknowledgments

The author would like to express his gratitude to the deans, program chairs, and administrative officials of the respective higher education institutions (HEIs) offering the BS Fisheries program for their assistance in gathering the necessary data. Appreciation is also extended to the Institute of Graduates and Professional Studies of Lyceum-Northwestern University for their academic and research guidance.

Conflict of interest

The author declares no conflict of interest.

AI DECLARATION STATEMENT

AI-supported tools helped with grammar and structure in creating this article. No AI tools were used to collect, analyze, or interpret data; all authors are credited for their academic contributions.

References

- Ahmadi, Mohamed, H., T., H., Ngo, T., N., N., Oo, A.N., Phomsouvanh, A., Sitha, H., & Velasco, P.L.(2011). Fisheries human resource: Gaps and requirements of Southeast Asia. *Southeast Asian Fisheries Development Center*.
<http://hdl.handle.net/20.500.12066/864>
- Baclig, C.E.(2026, March 17). Governance gaps deepen decline of Philippine Fisheries. *Inquirer*.<https://newsinfo.inquirer.net/2196902/governance-gaps-deepen-decline-of-philippine-fisheries-2>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*,3(2), 77–101.<https://doi.org/10.1191/1478088706qp063oa>
- Braun, V., & Clarke, V. (2021). To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qualitative Research in Sport, Exercise and Health*, 13(2), 201–216.
<https://doi.org/10.1080/2159676X.2019.1704846>
- Candano, R.(2025). Challenges Faced by Youth in Fisheries and Aquaculture Value Chains. *Department of Science and Technology-Philippine Council for Agriculture, Aquatic and Natural Resources Research and*

Development.<https://ispweb.pcaarrd.dost.gov.ph/challenges-faced-by-youth-in-fisheries-and-aquaculture-value-chains/>

Edge, D.E.(2016).Learning for the future: Educating career fisheries and wildlife professional.*Mammal Study*, 41(2):61-69. <https://doi.org/10.3106/041.041.0203>

Hakan, E. (2021, October 6).Challenges of the fisheries and aquaculture sector in the Global South. *Environment for Development*. <https://www.efdinitiative.org/blog/challenges-fisheries-and-aquaculture-sector-global-south>

Gerona, J.B. & Betito, R.D. (2025). Challenges in teaching agriculture and fishery arts to Grade 7 students by non-agriculture and fishery arts faculty. *Pantao: International Journal of the Humanities and Social Sciences*, 4(1).<https://doi.org/10.69651/PIJHSS040129>

Gervais, J. (2016). The operational definition of competency-based education. *The Journal of Competency-Based Education*, 1(2), 98-106.<https://doi.org/10.1002/cbe2.1011>

Gills, R., Ramachandran, C., Vipinkumar, V. P., Kumar, M.,Varghese, I., Jayasankar, J., Padua, S., Kumar, R. N., Krishna, P., & Ambrose, T.V. (2023). Education – world of work mismatch: A multidimensional competence gap analysis for reorienting the fisheries vocational education system in India. *Current Science*, 124(11):1329.<https://doi.org/10.18520/cs/v124/i11/1329-1338>

Glen, V.D., Oli, A.G., Chrispin, C.L., & Durairaja, R.(2025). Uncovering the skills gaps on the competency needs of fishermen in the coastal districts of Tamil Nadu. *Research Square*. <https://doi.org/10.21203/rs.3.rs-6953227/v1>

Lincoln, YS. & Guba, EG. (1985). Naturalistic Inquiry. Newbury Park, CA: *Sage Publication*

Oracion, E. G., Bomediano, M. R., Calumpong, H. P., Abesamis, R., Montebon, R., & Malayang, B. E. N. S., III. (2020). Opportunities and Challenges to Fisheries Policy in the Philippines Today. <http://serp.pids.gov.ph/publication/public/view?slug=opportunities-and-challenges-to-fisheries-policy-in-the-philippines-today>. Accessed 24 Jul 2026.

Orofino, S., McDonald, G., Mayorga, J., Costello, C., & Bradley, D.(2023). Opportunities and challenges for improving fisheries management through greater transparency in vessel tracking. *Internal Council for the Exploration of the Sea (ICES): Journal of Marine Science*, 80 (4) :675-689. <https://doi.org/10.1093/icesjms/fsad008>

- Rosaldo, E.A. (2024). Employability of Bachelor of Science in Fisheries Graduates in Calabarzon-Input for Curriculum. *ISRG Journal of Arts, Humanities and Social Sciences*(ISRGJAHSS), 2(3).572-577.<https://doi.org/10.5281/zenodo.12593351>
- Sajesh, V.K., Suresh, A., Mohanty, A.K., Singh, V., & Ravishanhar, C.N.(2021). Skill development in marine Fisheries: Some reflections on the issues and ways out. *Indian Journal of Animal Sciences*, 91(7):518-524. <https://doi.org/10.56093/ijans.v91i7.115894>
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). *Education for Sustainable Development: A Roadmap*. ISBN: 978-92-3-100394-3. <https://doi.org/10.54675/YFRE1448>
- Yadava, Y.S.(2000).*Skills Gaps and Training Needs Analysis of the Department of Fisheries, Tamil, Nadu, for Sustainable Development and Management of Fisheries.Bay of Bengal Programme. Chennai, India. Food and Agriculture Organization.*<https://www.fao.org/fishery/docs/CDrom/bobp/cd1/Bobp/Publns/MM/003.pdf>