

Delivering scientific diver training for underwater archaeology: international best practice in education and a micro-credential case study

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ABSTRACT

Delivering education in underwater archaeology is challenging for a variety of reasons, including the requirements to prepare archaeology students to become professional scientific divers. In practice, the discipline blends traditional academic and commercial archaeology with maritime sectors and diving industries. This paper discusses the principles of conducting safe underwater archaeology by trained divers and presents a case study of applied specialist training for diving maritime archaeology students at Flinders University, South Australia. We have developed an accredited micro-credential qualification in Professional Scientific Diving that meets the standards for both Australian Standards and the American Academy for Underwater Sciences (AAUS), enabling graduates to be classified as diving-workers under legal regimes where qualifications and professionalization are required. Delivery of this educational component within a maritime archaeology program is now critically important for career progression in underwater archaeology. We discuss the challenges of teaching diving for archaeology in a modern university with complex health and safety requirements and regulatory frameworks. We consider the barriers facing educators, students and professionals and how to create a safe and inclusive culture of scientific diving, critical to modern maritime archaeology and marine science in the coming decades.

KEYWORDS: Scientific Diving, Professional Practice, Underwater Archaeology, Diver Education

INTRODUCTION

In 2016, at the annual general meeting of the UNESCO UNITWIN Network for Underwater Archaeology, network members undertook a workshop on *Reducing Barriers to International Partnership Working*. The workshop identified a number of potential barriers to diving for archaeology, including Compliance Cultures (and working across different bureaucracies), Safety Cultures (a relative term that carries cultural implications), Diving Insurance (i.e., financial risk management for individual divers and their institutions) and Defining the ‘Professional Archaeological Diver’ (competencies, qualifications, experience). These challenges collectively create a substantial administrative burden for university training of archaeological divers. To mitigate this, a project was initiated to create a model code of practice for the UNITWIN Network to reduce the challenges for staff and students to undertake partnership research and educational programmes that involve diving for archaeology.

Early examples of UNESCO work in this space include the first Code of Practice for Scientific Diving: Principles for the Safe Practice of Scientific Diving in Different Environments (Flemming and Max 1988) and a short section on diving safety and compliance considerations in the UNESCO *Manual for Activities Directed at Underwater Cultural Heritage* (Maarleveld et al. 2013). Since the UNITWIN Model Code of Practice was first discussed in 2016, Flinders University has hosted two single-day symposium events in Adelaide, South Australia—in 2017 and 2022.

After three years of discussions between Network Members, the Model Code of Practice for Safe Diving Operations (Benjamin et al. 2019) was published online in June 2019. Importantly, it received the endorsement of the UNITWIN Network and ICOMOS ICUC, whose members were invited to respond to early drafts. The document provides a non-prescriptive model, with consistent practice and common language related to scientific archaeological diving, to serve as a starting point for network members to be able to dive safely, particularly members and aspiring members who do not already have a diving procedure

or code of practice in place (Benjamin et al. 2019, 4). The model code of practice, now published online in English and Japanese (www.underwaterarchaeology.net), is 20 pages in length and covers, among other things, background, tools, roles, training and testing, medical fitness, dive planning and record keeping.

CASE STUDY FROM FLINDERS UNIVERSITY MARITIME ARCHAEOLOGY PROGRAM

In 2022, the Flinders University Maritime Archaeology Program (FUMAP) celebrated its 20th anniversary of providing postgraduate degrees. Throughout that time, archaeological diving in Australia has been complicated by several factors, including regulatory requirements that vary from state to state and a national standard for scientific diving (AS/NZS 2299.2) that has not been updated since 2002, despite changing regulations. For many organisations with a role in underwater heritage, including universities, government agencies and heritage professionals, the questions of who is allowed to dive for archaeology and which qualifications are fit-for-purpose have been confusing and inconsistently resolved. This has only served to deter archaeological training and project work, which has stunted the development of the discipline, particularly in training underwater excavation methods (see also Benjamin and Mackintosh 2016).

A sustainable maritime archaeological community requires a culture focused on safe diving and an understanding of the responsibilities that come from diving while classified as a worker. The late Professor George Bass, who authored the benchmark *Archaeology Under Water* in 1966, is often credited for having said it is easier to teach an archaeologist to dive than it is to teach a diver to become an archaeologist, an observation also made by Professor John Goggin in 1959 (Goggin 1960, 350). The discipline of maritime archaeology today requires professionalism in both diving and archaeological training and must consider qualifications, competencies, compliance and work health and safety regulations that Bass would not have encountered at the beginning of his career as a diving archaeologist.

It is now clear that recreational diving qualifications may be suitable for entry-level, restricted student divers, but that more serious consideration of responsibilities as part of the workforce requires further training and experience. In Australia, the most common vocational training pathway for ‘occupational divers’ (which meets the Australian Standard series 2815 referenced in most state regulations) has typically been undertaken by private commercial diving schools that have been accredited through a private ‘Registered Training Organization (RTO)’, which in turn is accredited under the Australian Qualification Framework and the Australian Skills Quality Authority (ASQA).

Commercial diving training, however, does not necessarily prepare one for a career in underwater archaeology or marine science. Skills, risks and pressures are different, and the culture of the sectors and overall approach to diving are often contrasting. For the most part, scientific divers and underwater archaeologists work on SCUBA, using small hand tools and light powered water dredges or airlifts. Certainly, there are risks associated with these kinds of activities, and these must be managed in line with regulations and cultural expectations, but it is refreshing to see some movement in this space, with more interest in a revitalized scientific diving sector than in past decades and a promise of new scientific diving standards over the horizon. There is also a newly recognised way for universities to include accredited qualifications under the Australian Qualification Framework, Tertiary Education Quality and Standards Agency (TEQSA).

The TEQSA pathway enables universities to create an accredited program for qualifications, and this can include scientific diving. The most recent occupational diving standards in Australia have now included this in the training standard; a pathway to recognised professionalism that had been omitted previously. Since Flinders University is a TEQSA Registered University, FUMAP staff were able to undertake a multi-year project to develop a curriculum that best serves the program’s graduates, meets the Australian 2815-series Standard and has embedded within it the American Academy of Underwater Sciences training program.

This not only ensures international best practice, but also provides a widely accepted international scientific diver training qualification for our graduates working outside of Australasia.

Scientific Diver Training Structure and Delivery Guidelines

The Professional Scientific Diver micro-credential (MICR-PSDC) certification ensures the competency requirements of the graduate, as defined in Australian Standard 2815.6, and is internationally aligned with and meets AAUS Standards (2019), ANZSDA guidelines and the UNESCO UNITWIN Network for Underwater Archaeology Model Code of Practice for Safe Diving Operations (Benjamin et al. 2019).

Flinders University has a long history of teaching underwater skills. In recognition of this existing activity, MICR-PSDC remains student-focused, formally acknowledging the skills and competencies of our graduates. Flinders has never taught non-divers how to dive, and we have maintained this stance. Within the new micro-credential, we only teach existing, competent SCUBA divers to become professionals, capable and qualified to undertake scientific diving for professional research and educational purposes under Australian Standard 2299.2 Scientific Diving Operations (Figure 1).

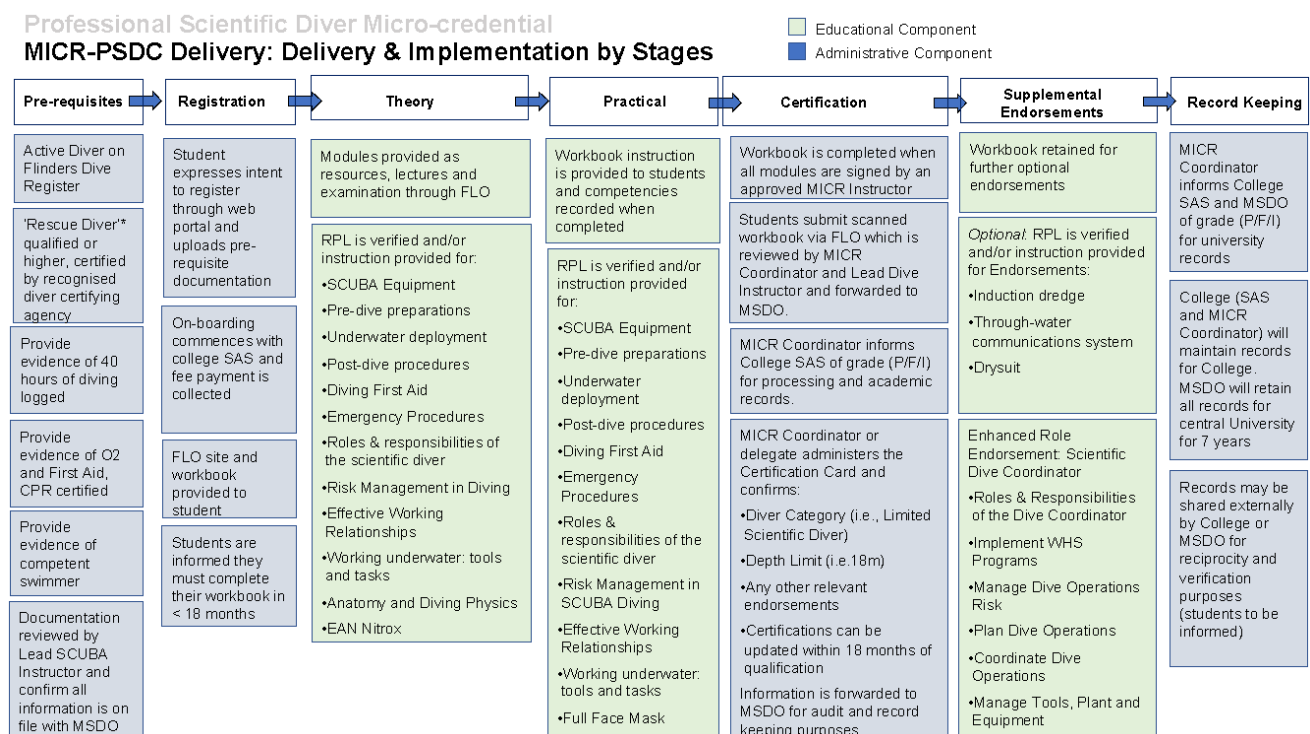


Figure 1. MICR-PSDC delivery and implementation

The primary educational aim of this micro-credential is to provide students with theoretical and practical knowledge and confirm that they have the competencies necessary to conduct research and educational activities under water as a professional scientific diver. MICR-PSDC also aims to introduce students to the basics of techniques for underwater archaeology and marine science, present students with opportunities to apply their practical and interpretive skills during problem-solving exercises and provide students with a certification that aligns to recognised standards for industry recognition.

Upon completion of this micro-credential, students are able to apply compliance and safety requirements to undertake scientific diving per Australian Standard AS2299.2 and AS2815.6; minimise their impact on the underwater cultural heritage and environment through improved diving skills and proper control of buoyancy, stability and trim; explain how to conduct underwater archaeology and marine science as a Scientific Diver; apply the practical and theoretical skills for scientific diving to future research and educational projects; and distinguish Scientific Diver training from Recreational and Commercial training pathways.

Roles and Responsibilities of Personnel

MICR-PSDC is delivered by a team in the College of Humanities Arts and Social Sciences (CHASS), which is the home college of FUMAP (Figure 2). Nevertheless, following the initial rounds of internal implementation and curriculum development in 2021, staff and students from other colleges at Flinders University with an interest in scientific diving have also been invited to participate.

Professional Scientific Diver Micro-credential

MICR-PSDC Delivery: Involvement of Roles by Stage

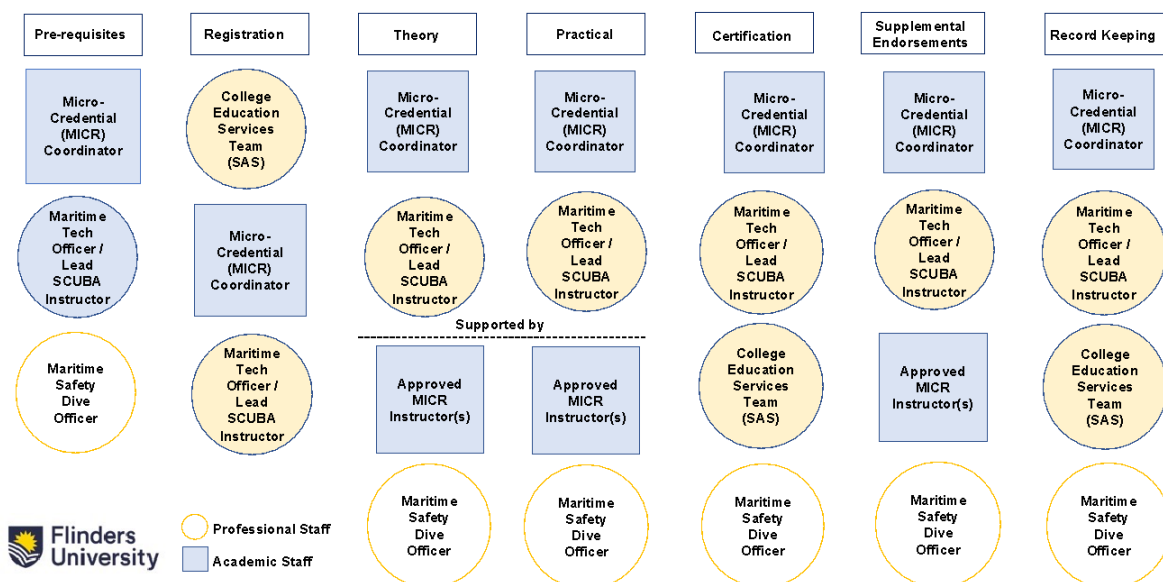


Figure 2. Involvement of roles in MICR-PSDC delivery

The *Academic Coordinator* of MICR-PSDC has overall responsibility for administering and delivering the course content and for student assessment and completions. The Academic Coordinator must be a suitably experienced Scientific Diver with training and experience in all aspects of training to be delivered (i.e., must hold qualifications that meet all competencies outlined in AS 2815.6), have competencies of a professional diving instructor (i.e., be at least an Assistant SCUBA Instructor per ISO 24802-1), be registered as a Flinders University Diver and be authorised as a Dive Coordinator.

The *Lead SCUBA Instructor* (LSI) is the delegated technical SCUBA Diving instructor and must hold qualifications that meet all competencies outlined in AS 2815.6 and be able to certify Autonomous SCUBA Divers (i.e., be a SCUBA Instructor per ISO 24802-2).

An *Approved Instructor / Assistant Instructor* (AI) is a supportive Academic or Professional Staff who is qualified and experienced to oversee and instruct elements delivered in MICR-PSDC. An AI must hold

qualifications that meet all competencies outlined in AS 2815.6. The individual must also hold qualifications that meet all competencies outlined in ISO 24802-1 OR they must meet all competencies outlined in ISO24801-3 (e.g., Divemaster) plus have formal qualification in training and assessment from higher education or vocational education pathways (e.g., Flinders Foundations of Teaching or Certificate IV in Training and Assessment). An AI must also be listed as a Registered Diver and Dive Coordinator in the Flinders Diver Register.

The *Maritime Safety Dive Officer (MSDO)* in Flinders University's organisational system is the specialist diving and boating officer employed by the University's Work Health and Safety Office. The MSDO is charged with assisting all dive management tasks and providing advice to staff and students on university policy and procedures as they relate to safe diving. The MSDO undertakes audits of diving practices to ensure compliance with relevant standards, adequate assessment of all divers' competencies and proper record keeping. The MSDO is responsible for ensuring that staff and students undertaking diving activities are appropriately trained and competent for the diving to be undertaken, and for approving Dive Plans prior to any diving activity commencing. The MSDO approves all new divers, all assigned diver categories and the status of all dive coordinators for Flinders University diving operations.

Student Registration and Certification Process

Onboarding of the students takes place through the College administration, with formal approval from the Academic Coordinator. Once prerequisites are confirmed and students are registered, they are given access to the MICR-PSDC site on the Flinders Learning Online (FLO) platform and provided with their Professional Scientific Diver Training Record Book, or 'Workbook'. Minimum prerequisites to enrol in the micro-credential are *Rescue Diver* certification from a recognized recreational diver training agency (e.g., PADI, SSI, TDI); 40 hours of logged dives; a valid medical certificate of diver fitness (per Australian Standard AS 2299.1 supplement); and valid First Aid, CPR and Emergency Oxygen Provider certifications.

Recognition of Prior Learning (RPL) is the process for assessing an individual's relevant prior learning, including formal, informal and non-formal learning. It is a legal requirement and an important part of MICR-PSDC. Generally, we will permit RPL for individual competencies when provided evidence for three times what is required in the standard (AS2815.6). Thus, if a student is requesting to receive RPL for diving experience, they must show verifiable evidence for three times the minimum number of dives and minutes at depths specified by the standard. Verification may entail written, logged or trusted communication, or may require physical verification. A student may be required to sign a statutory declaration to confirm, in legal terms, that they have completed the activities for which they apply. In practical terms, all skills and competencies are verified in person by a qualified instructor.

Theory is delivered online and in class, and all materials are available via FLO. International best practice in Scientific Diving is ensured through third-party audits by the Australia/New Zealand Scientific Diving Association (ANZSDA), which undertook an independent review of the curriculum and confirmed that it meets all Safework and Australian Standard AS 2815.6 requirements. A series of theoretical learning modules and short examinations are provided to the students as resources, with students required to achieve 100 per cent on the dive planning exam and 70 per cent or higher on all other exams to pass the theoretical modules.

Practical training activities (experience-based learning) are documented in the Workbook. This is the main record of competencies achieved through a combination of training and verified RPL, which comprise all competencies required for compliance with AS2815.6. All individual activities must be completed and signed off by the Academic Coordinator, the Lead SCUBA Instructor or Approved Instructors for the workbook to be completed. A Workbook is only complete when the student has achieved all listed

competencies AND made at least 50 logged dives in total. It can then be uploaded for review for certification. The AAUS modules must also be completed through the online AAUS training platform.

Certification is possible once a student successfully completes all theoretical and practical training and their Workbook is reviewed and approved by the Lead SCUBA Instructor and Academic Coordinator. Records are sent to the MSDO for compliance, auditing and record-keeping purposes. Academic marks are required and, in this case, are issued as Pass/Fail. They are sent to College Student Administration Services for processing and academic record-keeping. A certification card is generated by the Academic Coordinator on behalf of the College. It includes the date of issue, the diver's depth limit, any other restrictions or supplemental endorsements and the following statements:

1. this certification meets the requirements of AS2815.6 and AAUS Standards;
2. this certification card is valid only with a valid diving medical issued within 12 months; and
3. it is the responsibility of the named diver, and any institutional dive officer deploying the diver, to ensure the card holder does not operate beyond their training.

Supplemental endorsements are undertaken and administered in a similar manner as the core theoretical and practical competencies (Figure 3). Supplemental endorsement competencies are not required to achieve MICR-PSDC certification, but they are required to be granted the relevant endorsements listed on the certification card.



Figure 3. The use of a water dredge during field school represents one possible ‘supplemental endorsement’ for the certified Professional Scientific Diver. (Jonathan Benjamin)

Record-keeping is carefully maintained, with records kept by the College and centrally by the MSDO for at least seven years. Records may be shared externally for purposes of reciprocity and verification. Students are instructed to keep their Workbook and records of all activities in perpetuity. The MSDO undertakes regular reviews and audits to confirm that the course continues to be compliant with relevant standards.

IMPACTS AND CONCLUSION

The Professional Scientific Diver micro-credential is now in its third year at Flinders University. Although not quantifiable, staff and students have already noticed a marked improvement in the quality of our student divers. This is important, especially for our maritime archaeology field schools. Since MICR-PSDC student divers are already trained in and devoted to diving and safety through their existing training and practice, they can better focus on the archaeological tasks, underwater field methods and learning outcomes rather than on diving-specific components at the cost of their archaeological practice. Students who have taken the micro-credential are noticeably more competent and confident, in and out of the water. Diving routine is almost second nature, so they tend not to waste time during equipment preparation, safety checks, briefings and acclimation to the submerged environment. MICR-PSDC students also teach, both directly and indirectly and to the benefit of both, the less experienced restricted student divers, and in this way both the culture during field schools and standards of diving are noticeably improved.

Diving is not a prerequisite for postgraduate studies in maritime archaeology at Flinders; however, there is a new generation of graduates who are divers and who will leave our maritime archaeology postgraduate program with an accredited qualification as a Professional Scientific Diver embedded in their degree (Figure 4). Aligning the diving qualification to both Australian Standards and the internationally recognised AAUS (American) Standard means that the program facilitates the best opportunities for our graduates to work safely and professionally around the world where, increasingly, they will be asked to produce evidence that they are suitably trained, competent and qualified as professionals in both archaeology and scientific diving.



Figure 4. Our first graduating class of Professional Scientific Divers in 2021. (Hiro Yoshida)

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