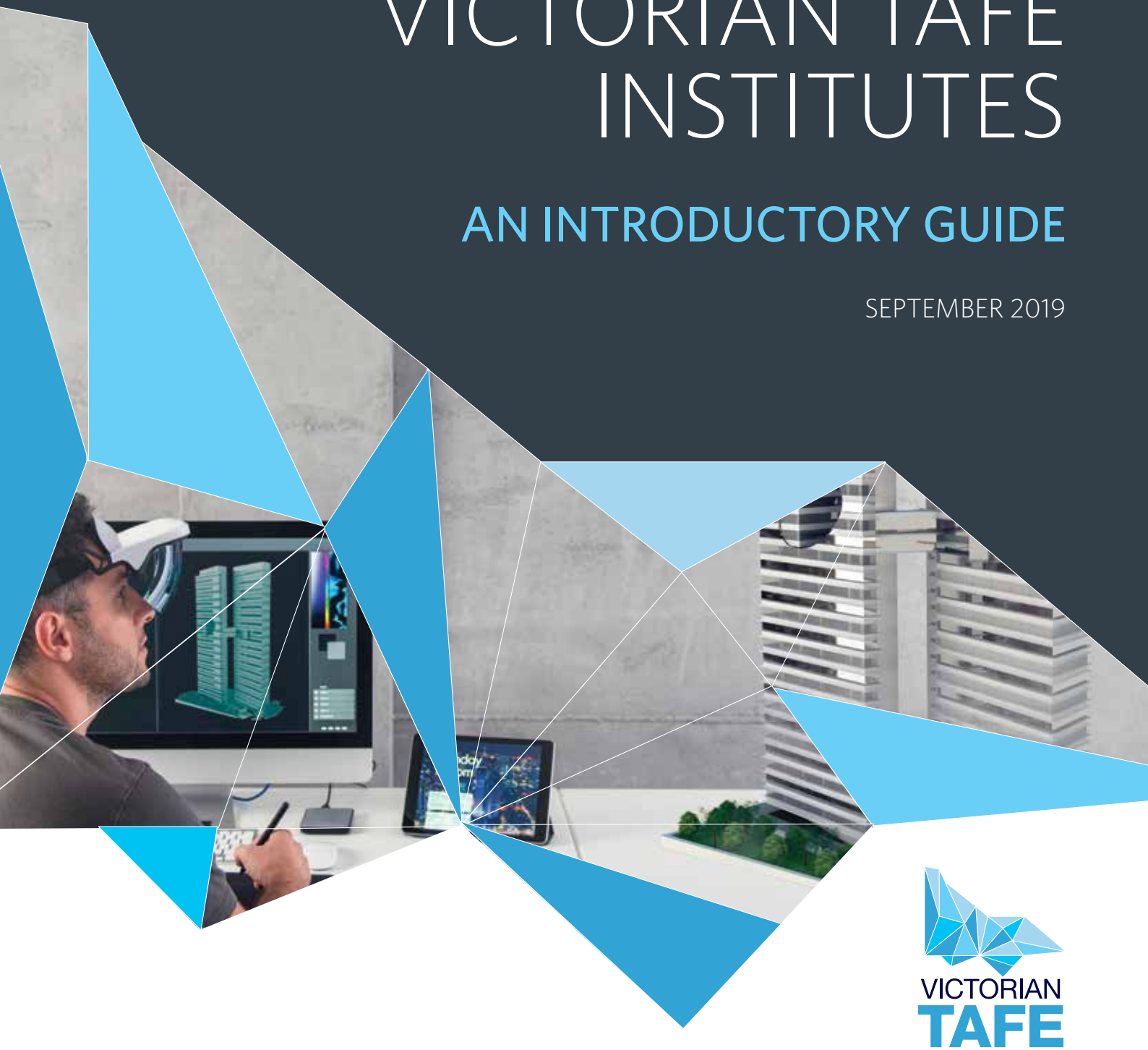
DOING APPLIED RESEARCH IN VICTORIAN TAFE INSTITUTES

AN INTRODUCTORY GUIDE

SEPTEMBER 2019



VICTORIAN TAFE ASSOCIATION

ALL PROGRESS IS BORN OF INQUIRY.

DOUBT IS OFTEN BETTER THAN OVERCONFIDENCE, FOR IT LEADS TO INQUIRY, AND INQUIRY LEADS TO INVENTION.

HUDSON MAXIM

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LIST OF ACRONYMS

ARC	AUSTRALIAN RESEARCH COUNCIL
HE	HIGHER EDUCATION
HEP	HIGHER EDUCATION PROVIDER
R&D	RESEARCH AND DEVELOPMENT
TAFE	TECHNICAL AND FURTHER EDUCATION
VET	VOCATIONAL EDUCATION AND TRAINING
VTA	VICTORIAN TAFE ASSOCIATION

OVERVIEW

THIS GUIDE TO APPLIED RESEARCH WAS COMMISSIONED BY THE VICTORIAN TAFE ASSOCIATION (VTA) TO SUPPORT VICTORIAN TAFE STAFF MEMBERS, ESPECIALLY NOVICE RESEARCHERS, TO UNDERTAKE APPLIED RESEARCH. APPLIED RESEARCH PROJECTS MAY BE WITH AN INDUSTRY, COMMUNITY OR GOVERNMENT PARTNER OR UNDERTAKEN WITHIN TAFE TO IMPROVE PROFESSIONAL PRACTICE, COURSES AND PROGRAMS.

The term 'research' evokes images of university academics, scientists in laboratories, students studying a Master Degree or PhD and professional researchers working on big social, economic, technological or medical problems.

It is unlikely that applied research in TAFE comes to mind, even though it has been occurring for many years and is a growing trend in similar institutions around the world.

As far back as the Kangan report in the 1970s, training in research was seen to be needed in vocational education and training (VET). But research in VET is still not an accepted part of professional practice.

Only some people are doing it. But, when one really thinks about it, all of us do 'research' of some kind at one time or another.

For example, thinking about a new car to buy or an appliance that best meets our needs. Doing research in VET should not really be something that is unusual.

When research does occur in Victorian TAFE institutes and dual-sector universities, it is an applied, practical and creative activity that draws on accepted research methods to find practical, evidence-based solutions to problems.

The aim is usually to:

1. Solve real world problems (or opportunities) for industry clients,
2. Advance professional knowledge, theory and practice in TAFE,
3. Foster research and innovation literacy[1] in TAFE graduates, and/or
4. Evaluate the effectiveness of their practice in order to improve it.

These applied research activities clearly offer significant benefits for TAFE and dual-sector universities and their students and industry, community and government partners and often result in effective innovations, as case studies in this Guide illustrate.

These describe new water saving technologies for buildings, weather-monitoring devices for farmers, new designs for train door handles, innovative ways to use the by-products of fermenting wine, and new and improved teaching practices.

However, much of this activity is not recognised as research or published to a wider audience (Jonas, 2012), although there is a surprising amount of VET research available (see Attachment 12).

[1] Innovation literacy includes critical and creative thinking, problem solving, creative and entrepreneurial skills and capabilities (Luke, 2013).

WHY DO WE NEED APPLIED RESEARCH IN TAFE?

IN LATE 2018, VICTORIAN TAFE TEACHERS AGREED TO A NEW MULTI ENTERPRISE AGREEMENT (THE VICTORIAN TAFE TEACHING STAFF AGREEMENT 2018).

The Agreement incorporates applied research in teaching duties (clause 32.10 b) and in TAFE teaching qualifications at level 5 and above.

Schedule 4 in the Agreement links applied research with Ernest Boyer's (1990) Framework of Scholarship (see Attachment 1).Applied research is a discipline that takes time and experience to master.

This Guide aims to support all TAFE staff members in Victoria to build their applied research knowledge and expertise in:

- The fundamentals of applied research,
- The principles guiding ethical research practice,
- The benefits and risks associated with research,
- How to design a research project using accepted methods and techniques,
- Working with clients and/or students to implement a research plan,
- Potential funding sources and how to access them, and
- How to report and present research findings.

New researchers can learn how to do applied research while undertaking a research project with the guidance of an experienced researcher.

It is beyond the scope of this Guide to provide all the information and support they will need to plan and successfully complete an applied research project.

It is highly recommended that new researchers undertake further study in research methodology and refer to recommended research texts to develop their research knowledge and expertise.

HOW TO USE THIS GUIDE

THIS GUIDE SYNTHESISES A HUGE AMOUNT OF INFORMATION ABOUT RESEARCH DESIGN, METHODOLOGIES, TECHNIQUES AND STANDARDS INTO A ROADMAP THAT CONTAINS EIGHT DISTINCTIVE AND OVERLAPPING FEATURES OF APPLIED RESEARCH (FIGURE 1).

The eight features make up three main phases in the applied research process:

1. Planning (Features 1-3),
2. Implementation (Features 4-6), and
3. Sharing results (Features 7-8).

Applied research is subject to unpredictable interactions between people, organisations and the environment the research is conducted in and rarely follows a straight line from problem to solution. Researchers can find themselves moving back and forth between the eight features or working on different features at the same time.

See Attachment 2 for a brief overview of each research phase. Budding researchers can use this as a roadmap to guide their research journey.

It takes some time to become familiar with the applied research process. Start by reading through this Guide, bearing in mind that some information may not make sense on first reading.

This is a common complaint among new researchers so do not be deterred if you do not fully understand the concepts and techniques of research immediately. They can make more sense when applied in practice.

The Guide contains four distinct sections:

1. Introduction to applied research,
2. Getting started: planning a research project,
3. Implementing a research plan, and
4. Sharing results.

Each section starts with a summary of important points (what you need to know) and concludes with recommendations for further reading and handy tips from experienced researchers. Sample templates and additional resources are provided in the attachments for further assistance.

A brief overview of each section is provided below.

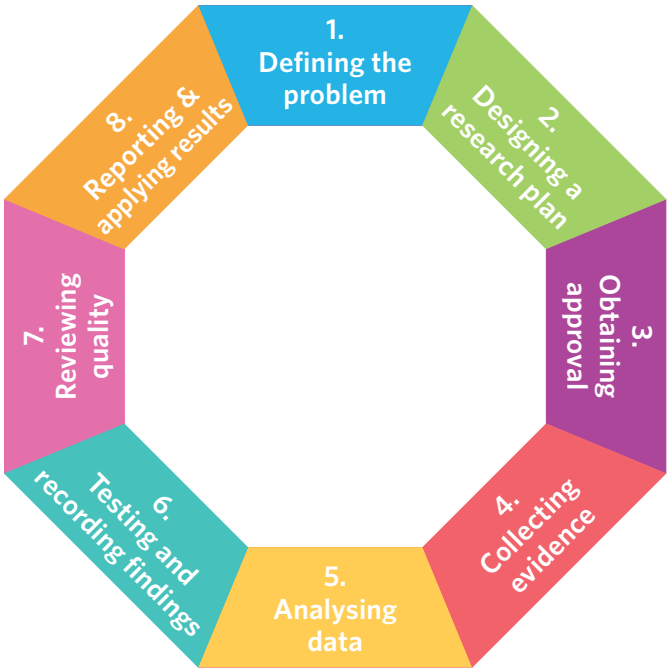


Figure 1: Features of applied research

SECTION 1: INTRODUCTION TO APPLIED RESEARCH

> Section 1.1 provides information about the fundamentals of research that is important to know before starting an applied research project.

> Section 1.2 investigates case studies of applied research in TAFE and TAFE's counterparts in Canada and England. The case studies show how applied research in institutes and colleges is a creative, practical and problem-solving activity that contributes to innovation in community and industry and brings significant value to students, staff members and partners.

SECTION 2: GETTING STARTED BY PLANNING

> Section 2.1 introduces you to the principles guiding ethics and integrity in research.

> Section 2.2 steps you through the features and activities involved in planning an applied research project. The process involves defining a research problem, setting goals and objectives, scanning the environment to find out what others know about the problem and choosing an appropriate research methodology.

> Section 2.3 discusses how to gain appropriate approval to proceed with your research project.

SECTION 3: IMPLEMENTING A RESEARCH PLAN

> Section 3.1 guides you through the preparation for fieldwork, the collection of information and data,

> Section 3.2 discusses how to analyse the data, and

> Section 3.3 outlines effective ways to record and document the findings of applied research.

SECTION 4: SHARING RESULTS

> Section 4.1 discusses the importance of peer-review and self-reflective practice by researchers to quality applied research outcomes,

> Section 4.2 concludes the Guide with brief overview of the different ways applied research projects can be reported and shared with clients and other audiences.

SECTION 1:
INTRODUCTION TO APPLIED RESEARCH

WHAT YOU NEED TO KNOW

> Applied research is an original investigation that:
- Applies knowledge to find practical solutions to problems in an industry,
- Is a creative process that seeks to generate new knowledge and understanding,
- Uses accepted methods and techniques to ensure valid outcomes, and
- Often results in outcomes with commercial value.

> Applied research in TAFE typically focuses on:
- Solving problems for local industries when no existing solution is available,
- Enhancing professional practice in TAFE, and
- Fostering innovation skills and capabilities in students.

1.1 WHAT IS APPLIED RESEARCH?

Applied research is a term that covers a large range of activities from collecting information about a market or population, to finding a cure for disease, to formulating new theories about a social problem to developing and testing new products, processes and services.

It is one of three types of research that make up the broad field of research and development (R&D):

1. Discovery (also known as pure, fundamental or basic research),
2. Applied research, and
3. Experimental development (OECD, 2015).[2]

Basic research sets out to acquire new knowledge to advance a body of knowledge about a subject or problem without a specific application or commercial outcome in mind (Ibid.).

Applied research is original investigation that acquires new knowledge but is directed toward finding practical solutions to problems, often for commercial gain. These might be new or improved products, operations, methods and systems.

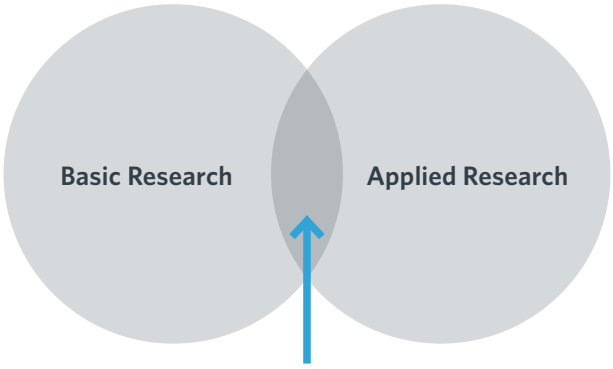
Experimental development uses the knowledge gained from basic and applied research to develop new or improved products, services and processes and is often referred to as the 'D' in R&D (Ibid.).

Experimental development is not product development but is part of the product development process. Examples of different types of R&D are provided in Attachment 3.

While basic research is generally associated with universities and research institutions, applied research and experimental development tend to be associated with solving technical, process and social problems in a community or industry.

The key differences between them are the time taken to achieve a result and the range of fields that they can be applied in (Ibid.). The more basic the research, the broader the field will be. Figure 2 illustrates some differences between basic and applied research.

[2] The definition comes from the Frascati Manual which is produced by the Organisation for Economic Co-operation and Development (OECD) to guide R&D in OECD member countries.



Basic Research

- Aims to advance conceptual knowledge and understanding of the universe.
- Asks why and how things work.
- Analyses properties, structures and relationships to formulate and test hypothesises, theories and laws.
- Does not seek immediate practical applications.
- Often funded by governments, universities and private foundations through grants.
- Evaluated by peers using academic standards.
- Made public through conferences and publications.

Shared Characteristics

- Systematic search for new knowledge.
- Original work that asks a question, often problem based.
- Draws on the broader research in a field.
- Uses accepted research methods and techniques.
- Adheres to ethical and quality standards and principles.
- Uses qualitative and/or quantitative research methods.
- Spurs questions and ideas for further research.

Applied Research

- Aims to solve specific individual, organisational or industry problems.
- Puts basic research into practice to achieve specific pre-determined objectives.
- Asks how does research apply in a specific environment.
- Is often client-driven with commercial objectives.
- Is evaluated by client and/or industry standards as well as academic standards.
- Can be subject to confidentiality and intellectual property agreements.

Figure 2: General characteristics of basic and applied research[3]

According to the Frascati Manual, all R&D activities must meet the following criteria:

1. They are aimed at new findings (novel),
2. They are based on original, not obvious concepts and hypotheses (creative),
3. They are uncertain about the final outcome (uncertain),
4. They are planned and budgeted (systematic), and
5. They lead to results that are possible to reproduce (transferable and/or reproducible) (Ibid.).

These criteria should guide the design, implementation and evaluation of applied research projects.

Applied research is therefore more than just a fact-gathering exercise or a problem-solving activity; it is a creative process that uses approved methods and techniques to find new, practical and evidence-based solutions to problems.

The outcomes of applied research can be key inputs for innovation, especially for the development of new or improved products, services or processes.

These are considered to be innovative when they differ significantly from previous versions and have been made either available to other users (product innovation) or brought into use (process innovation) (OECD/ Eurostat, 2018).

Product innovation (Figure 3) starts with (basic and/or applied) research into a problem or idea that provides the basis for the development and testing of a technology, material or product prototype that meets a real need. The result is then commercialised and launched into a market.

The development of compostable take-away coffee cups by college students in Canada is an example of applied research as part of a product innovation process.

The research solved a problem for industry (the disposal of non-biodegradable plastic cups) by producing a creative, practical, transferable and applicable solution.

[3] Please note that the list of general characteristics in Figure 2 is not exhaustive.

Figure 3: Product Innovation Model

Process innovation (Figure 4) follows a different path from problem to solution. Rather than tangible products for a market, process innovation results in new or improved business processes, practices or behaviours. It starts with research (basic and/or applied) into a problem relating to organisational or social processes or practices which then leads to recommendations for the development of new policies, processes, practices or interventions. The results are assessed in terms of potential impact on a social group before being implemented and disseminated more widely in a professional discipline.

For example, teachers at William Angliss (WAI) and RMIT are working with the Cardinia Shire Council in Victoria to investigate innovative ways to tackle high rates of obesity in the Shire affecting the health and wellbeing of residents. Working with the Council, the researchers are investigating innovative ways to raise awareness of healthy diets in the community and ultimately change dietary habits and behaviours.[4]

Figure 4: Process Innovation Model

In reality, both innovation processes can be far more complex and unpredictable than represented in Figures 3 and 4 as they are continually subject to competing interests and unexpected problems and changes in the environment in which they are conducted.

[4] www.angliss.edu.au/research/funded-academic-projects/

1.2 APPLIED RESEARCH IN TAFE

Applied research in TAFE is used to solve a problem, explore an idea, interest or opportunity, evaluate the quality of a product, service or program, obtain market intelligence and for product and process innovation.

An applied researcher in TAFE might wish to:

1. Investigate a technical, social, political or cultural problem in an industry, community or TAFE setting to find out why it is occurring and what can be done to solve it,
2. Support an industry or community partner to develop new or improved products, services and business processes and practices,
3. Test or evaluate the quality of a product, process or program in absolute terms or on a comparative basis,
4. Compare different cases of a problem to better understand what is happening,
5. Predict what might happen if a new plan, policy, technology, teaching practice or regulation is implemented,
6. Explore an issue, idea or problem related to teaching or other practices in TAFE to improve it, and/or
7. Involve students in research-based learning in real or simulated industry or community settings.

These applied research activities overlap when TAFE students are involved in applied research for an industry client, when industry clients need creative educational programs to solve a problem, or when TAFE teachers and students bring industry knowledge and experience back to TAFE to improve curriculum and teaching practices. They generally aim to achieve one or more of three main objectives:

i. Solving problems for industry and community clients,
ii. Advancing professional practice in TAFE, and/or
iii. Fostering research and innovation literacy in students.

The following section explores case studies from TAFE and dual-sector universities in Victoria and colleges in Canada and the United Kingdom (UK) that illustrate these aims and objectives.

i. SOLVING PROBLEMS FOR INDUSTRY AND COMMUNITY CLIENTS

Applied research projects for industry or community clients typically set out to solve technical challenges, business process bottlenecks and service delivery inefficiencies (VTA, 2016), develop or test new or improved products, services and processes or find solutions to controversies and problems.

They are usually subject to commercial contractual agreements to protect the intellectual property (IP) resulting from research and the confidentiality of business information of both parties.

Applied research occurs in real business environments where clients are key decision-makers in the research process who bring technical and business expertise and, in some cases financial support to research partnerships.

Many clients are micro or small to medium enterprises (SMEs) or community organisations that do not have R&D facilities or expertise and often confront problems that need solutions to a problem in a short time frame. However, TAFE also works with larger enterprises to solve systemic industry or community problems as the following case studies show.

CASE STUDY 1: APPLIED RESEARCH AT HOLMESGLEN FOR THE WATER INDUSTRY

In late 2015, South East Water approached Holmesglen's Plumbing Department to test a new sustainable water management system for a new housing development in south east Melbourne called 'Aquarevo'. The development is located next to a large wetland eco-system. The applied research team investigated processes to heat rainwater collected from house roofs for domestic use to reduce the use of potable (drinking quality) water.

The research also investigated potential impacts of filtered heated water on wetland environments and the implications of sustainable water management systems on town planning, building surveying and building design at the site.

Holmesglen's plumbing and building teachers worked with specialists from South East Water to construct a test rig at Holmesglen and test the performance of the new water filtering system. The rig included a simulated two-storey house and an assembly of water tanks, pumps, filtration systems and fixtures, valves and pump systems that were electronically monitored, recorded and tested over a period of twelve months.

The applied research resulted in the development and testing of a new heated rainwater system which is currently being implemented across the 500-home subdivision. It also resulted in an improved understanding of patterns in household water usage and how overall water footprint can be reduced in large housing developments. Holmesglen Institute is now planning to use this research to develop training programmes for apprentices and licensed tradespersons in the installation and use of these new technologies.[5]

CASE STUDY 2: APPLIED RESEARCH AT SKILLSTECH FOR THE GAS INDUSTRY

Trade teachers at SkillsTech (TAFE Queensland) worked with two international suppliers of high-pressure polyethylene (HDPE) gas pipelines and international gas experts to find and fix a problem related to leaking joints in a pipeline newly laid in the Western Darling Downs region (Redspace, 2016).

The problem, identified during the testing phase of the pipeline, had major potential implications for the coal and gas industry. The extraction of coal seam gas and conversion into liquefied natural gas is a significant economic opportunity for Queensland dependent on hundreds of kilometres of sealed pipeline infrastructure being successfully buried metres underground.

The applied research revealed problems with plastic welding techniques used to join large diameter pipes together which were causing the joints to crack and release methane gas. Further problems were caused by the contamination of welded joints by the sunscreen used by the welders on hot days.

The research team identified new work procedures and skills for HDPE welders, which led to a new industry training centre at SkillsTech. The team also provided technical advice for the development of a Code of Practice for the coal and gas industry by the Australian Pipeline and Gas Association (APGA).

[5] For more information see Holmesglen outlines South East Water Project and Aquarevo: A smart model for residential water management.

CASE STUDY 3: APPLIED RESEARCH AT SWINBURNE FOR THE MANUFACTURING INDUSTRY

Swinburne University's Design Factory Melbourne (DFM) provides applied research for industry in partnership with other research organisations in Australia and around the world. DFM is an applied research, design, manufacturing and teaching space. DFM brings together manufacturing businesses, students, teachers and members of the community to work on concepts for new products. Industry partners provide a brief for a new product, service or system. A multi-disciplinary team of teachers and students then take the idea and develop a prototype of a product for the client.

In 2012, DFM investigated a problem with automated train doors in Victoria for Metro Trains, which allowed passengers to force the doors open while a train was moving. After several dangerous incidents, Transport Safety Victoria (TSV) threatened to decommission the trains if the problem was not resolved. The research team undertook considerable user analyses, predictive modelling and concept development to produce a new handle prototype that opens easily when a train is standing still but is not openable while a train is moving.

The new design also removed a foothold that was used by illegal train surfers provided by the old model and reduced the number of passengers catching their clothing and bags on protruding handles while stepping on and off a train. The new handle design was tested and rolled out across the Metro fleet in 2015. Since then, overall punctuality across the train network has improved and service delivery complaints have declined.[6]

The applied research partnership model is also working well in Canada where public vocational colleges and institutes have been conducting applied research for industry for over a decade, mostly in the building and construction, healthcare, communication, natural resources, agriculture and agri-food and manufacturing industries (CICAN, 2018).

The model has been so successful, Canada now has 400 specialised applied research centres and laboratories operating in colleges and institutes working with over 7,000 industry partners.[7]

[6] Further information go to On track for outstanding outcomes
[7] See Colleges and Institutes Canada (CICAN) website at www.collegesinstitutes.ca/policyfocus/applied-research/

ii. ADVANCING PROFESSIONAL PRACTICE IN TAFE

Applied research is also used in TAFE to solve internal problems or ideas in teaching or business practices and to evaluate training programs to see how well they meet their stated objectives. Commonly known as action research[8] (Williams, 2013), practice-based research and inquiry (Cochrane-Smith and Lytle, 2009) or evaluation, applied research enables practitioners to question, investigate, theorise and reflect on their practice as part of lifelong learning and continuous improvement.

The requirement for novelty, creativity and uncertainty in applied research distinguishes it from routine teaching, business and problem-solving practices.

CASE STUDY 4: APPLIED RESEARCH AT NEWCASTLE COLLEGE FOR THE CYBER SECURITY INDUSTRY

A group of Further Education (FE) teachers at Newcastle College in England designed an applied research project to improve and renew a Cyber Security Foundation Degree. Feedback from industry revealed that students were not graduating with the skills and capabilities to work effectively in the industry.

The research team worked with industry partners, law enforcement and intelligence agencies and cyber-security students to identify the challenges faced by the industry and the skills and capabilities people need to work in high-pressured, commercial cyber security environments. The findings informed the development of new curriculum, assessments and delivery models based on student internships, where students are paid to work in industry on real cyber security problems as part of their studies.

Industry partners also facilitate two week applied research secondments for teachers to investigate specific workplace problems. The result of the applied research is strengthened relationships between Newcastle College and local employers, improved employment outcomes for graduates and a stronger reputation for the College's cyber security courses.[9]

CASE STUDY 5: APPLIED RESEARCH TO IMPROVE OUTCOMES FOR REMOTE LEARNERS

A TAFE teacher in NSW had a keen interest in improving VET outcomes for learners in a remote Aboriginal community. The learners were experiencing complex barriers to VET including limited opportunities for employment and access to transport and other services. Delivering in these communities presented a 'wicked problem' for providers, compounded by a 'thin market' and very weak links between VET qualifications and work opportunities (Bowtell, 2014).

Standardised approaches to VET in these communities struggle to overcome the multiple barriers to participation experienced by learners. Notably, the emphasis on learning in the workplace has significant implications for unemployed learners who live in communities with high unemployment rates.

The teacher investigated different forms of learning that might enhance the VET experience. Talking directly to learners, she found that informal and non-formal learning experiences that are based in local community culture, language, relationships and networks are just as important to developing vocational skills and critical thinking and creative capabilities in a chosen career as the formal learning acquired through a VET qualification.

Indeed, informal and non-formal learning opportunities were considered by learners to be more relevant and valued than formal learning opportunities. While a small study, the teacher concluded that integrating the three forms of learning can make VET more meaningful and inspiring for remote Aboriginal learners in their chosen vocation (Ibid.). [10]

[8] In action research, the researcher is usually a participant in the research and a member of the community under study.
[9] For more information, see Second Research and Scholarship in College Higher Education (Lea, 2016: 8)
[10] The research paper for this case study is available at www.voced.edu.au/content/ngv%3A62534

iii. DEVELOPING RESEARCH AND INNOVATION CAPABILITY IN TAFE STUDENTS

When students are involved in applied research projects in TAFE in real or simulated industry environments, they have the opportunity to develop research and innovation skills and capabilities under the guidance of teachers.

Applied research is an experiential learning experience (Kolb, 1984) that requires students to explore a problem in a creative and systematic way.

While problem-based and project-based learning approaches are familiar in TAFE, they have often lacked the rigour of research methodologies and the challenge to make sound judgements using critical and objective thinking.

Fostering innovation and entrepreneurship in students is the primary purpose of applied research in community colleges and institutes in Canada.

Over 25,000 students are engaged in applied research projects each year through in-class projects, unpaid or paid research assistant work, internships with industry and community clients and through capstone projects to complete a qualification (CICAN, 2016: 16).

CASE STUDY 6: APPLIED RESEARCH BY STUDENTS AT MELBOURNE POLYTECHNIC

Students in each year of the Bachelor of Agriculture and Technology (agribusiness, aquaculture, viticulture and winemaking) at Melbourne Polytechnic undertake applied research projects for industry at a level appropriate to their academic level.

In one example, a group of students worked with a South Australian wine company to investigate new ways to capture volatile organic compounds and ethanol produced by fermenting wine and recycle them into usable products. Usually treated as waste by-products of wine, the research team recycled the organic compounds into bio-chemicals and the ethanol into flavour additives to enhance the wine.

The students also investigated new ways to recycle carbon dioxide (CO2), another by-product of fermenting wine. A second group of aquaculture students worked with an industry partner to investigate the use of by-products for growing algae in bio-fuel production.[11]

CASE STUDY 7: APPLIED RESEARCH BY STUDENTS AT SWINBURNE

After developing applied research capability during their undergraduate studies, higher education students at Swinburne University's Design Factory Melbourne worked with the Bureau of Meteorology (BoM) to develop a new weather monitoring system for farmers based in remote areas. With growing unpredictability in weather due to climate change, the BoM was experiencing problems providing timely localised weather information for farmers including weather alerts and warnings.

Using the principles of design thinking, an interdisciplinary team of students (communication design, electronic engineering, digital media design, accounting and finance and science) worked with BoM and farmers to test the existing weather monitoring stations to identify the problem. After analysing the data, the students developed a small, efficient and cost-effective prototype called FarmSense, which collects live data from remote locations for BoM which is sent to farmers via wireless connection to their smartphones.

This case study illustrates the potential for students to work on high level research projects when they have developed applied research capability during their studies. It also demonstrates the value of students from different industry disciplines working together on applied research projects.[12]

[11] For more information, see Applied Research Case Studies, go to www.vta.vic.edu.au/research-directory/case-studies
[12] More information can be found at www.dfm.org.au/project/farmsense/

CASE STUDY 8: APPLIED RESEARCH BY STUDENTS IN CANADA

Red River College of Applied Arts, Science and Technology in Manitoba, Canada has several applied research centres, some which specialise in sustainable infrastructure and building technologies. One such centre collaborated with Manitoba Hydro to investigate the effects of air leakage on energy use, air quality, comfort and durability in extreme cold climates.

Collaborating with a commercial research company, teachers and students at the College tested air leakage in 26 buildings to establish baseline rates for air leakage and testing protocols for building standards (CICAN, 2015). The research team installed a network of sensors in a new trade centre at the College and tested, compared and monitored the performance of different building materials and advanced sensor networks. This process was coupled with data visualization techniques. The research findings were presented at the Conference on Intelligent Infrastructure held in Brisbane in December 2017.[13]

Students at Southern Alberta Institute for Technology (SAIT) in Alberta tested the performance of a new solar tracker (a device designed to track energy generated by the sun) for a local renewable energy company. They subjected the solar tracker to rain, ice, and other extreme weather conditions and measured its performance under each condition (CICAN, 2018).

[13] More information is available at: www.rrc.ca/research/

1.3 APPLIED RESEARCH AND SCHOLARSHIP

Much of the research activity described in the case studies above fit with Boyer's (1990) scholarship of application (also known as the scholarship of engagement) and the scholarship of teaching (for more information on Boyer's four scholarships see Attachment 1).

The scholarship of application sets out to find ways to apply knowledge to solve problems in the service of the community. The scholarship of teaching investigates new knowledge and practices to improve the quality of teaching for the benefit of students.

Both forms of scholarship bring theory and practice together to generate new knowledge and innovation in an industry discipline and are highly relevant to TAFE's applied learning environment and close links with industry.

CASE STUDY 9: SCHOLARSHIP AT WILLIAM ANGLISS

As a Specialist Centre for the Hospitality, Tourism and Culinary professions, William Angliss Institute (WAI) aspires to become a University of Specialisation. To build the research capability required of a university, WAI has implemented a Research Strategy and Research and Scholarship Framework based on Boyer's framework of scholarship. The current focus at WAI is developing the scholarship of teaching and the scholarship of application in teaching staff in line with the Institute's industry specialisations.

Teachers are encouraged to undertake planned, rigorous and reflective applied research into an aspect of their teaching. Funding is available to support this research and also to support applied research for industry and to support staff members to complete higher qualifications. The research capability of teachers is assessed in three ways: 1) in their area of industry specialisation, 2) in their discipline, and 3) in their use of research methods and techniques. Teachers are also supported by professional development in research methods and techniques and by experienced mentors from WAI's College of Eminent Professors.[14]

FURTHER READING

> For examples of TAFE teachers using applied research to improve teaching practices, see www.voced.edu.au/search/site/sm_metadata.collection%3ACommunitiesOfPractice?solrsort=ss_dateNormalized%20desc

> For more examples of applied research partnerships in community colleges in Canada,

- The college innovation program: Partnerships for industry innovation (2015) and Applied Research Comes of Age (2018)

> Applied research in VET: VET applied research: driving VET's role in the innovation system

> Ernest Boyer (1990): Scholarship Reconsidered. Priorities of the Professoriate and 1996 essay The Scholarship of Engagement

> The scholarship of application in TAFE, Scholarly engagement: Building knowledge in industry and the community in mixed-sector institutions

> Case studies of applied research in Victorian TAFE Institutes

> Scholarship in the FE sector in the UK, www.aoc.co.uk/think-pieces

> AVETRA resources for VET researchers

[14] More information can be found at: www.angliss.edu.au/research/funded-academic-projects/and www.angliss.edu.au/research/

SECTION 2:
GETTING STARTED

WHAT YOU NEED TO KNOW

> Applied research follows three main phases::
  1. Planning,
  2. Implementation, and
  3. Sharing results.

> Good planning is fundamental to quality research outcomes. It involves:
  - Defining a research problem and question,
  - Finding out what others know about the problem, and
  - Designing an appropriate methodology

> The primary responsibility for ethics and integrity in applied research lies with individual researchers and their institutions.

Section 2 of this Guide steps you through the process of planning an applied research project. This involves the first three features of applied research (Figure 5):

1. Defining a research problem/ question,
2. Designing a research plan (methodology),
3. Obtaining approval to proceed with fieldwork.

While these features are sequential, they rarely follow a neat linear process where one feature is completed before the next feature commences.

Applied researchers often find themselves moving back and forth between features as they encounter problems and gain new knowledge and perspectives on a problem.

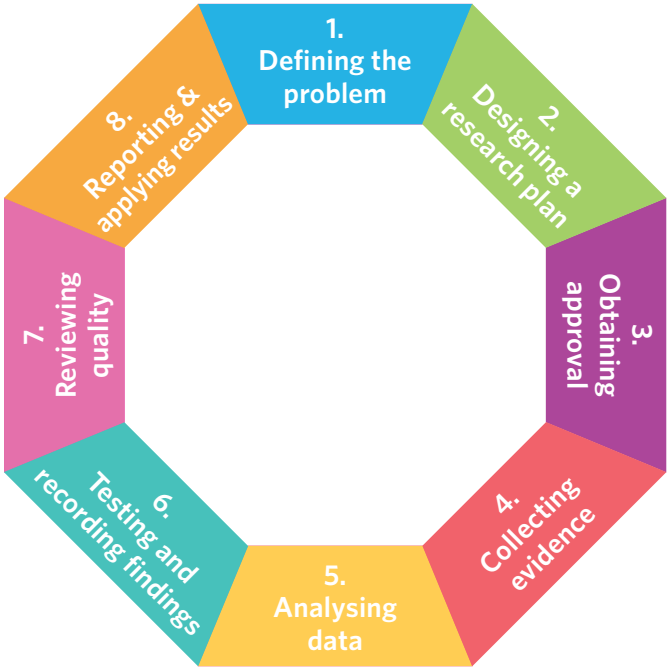


Figure 5: Features of applied research

2.1 ETHICS AND INTEGRITY IN RESEARCH

Before you start planning a research project, it is important to understand the principles underpinning ethical research in Australia. Researchers are trusted to conduct research in an honest, ethical and responsible manner that prevents bias in their findings as much as possible.

Bias can occur when personal judgements (either unconscious or conscious) interfere in the research process and lead to the rejection of evidence contrary to one's beliefs, being too selective when presenting the findings of research or misrepresenting research results. Bias can also arise to conflicts of interests when:

- Family or friends are involved in a research project,
- Researchers' business interests, or those of affiliated organisations, are influenced by the research outcomes, or
- Gifts and other benefits are accepted by researchers during the research process.

The Australian Code for Responsible Conduct of Research (2018) outlines eight principles for responsible research:

1. Honesty in the development, undertaking and reporting of research,
2. Rigour in the development, undertaking and reporting of research,
3. Transparency in declaring interests and reporting research methodology, data and findings,
4. Fairness in the treatment of others participating in the research,
5. Respect for research participants, the wider community, animals and the environment,
6. Recognition of the right of Aboriginal and Torres Strait Islander peoples to be engaged in research that affects or is of particular significance to them,
7. Accountability for the development, undertaking and reporting of research, and
8. Promotion of responsible research practices.

Principles 4 – 6 protect people who provide data for research from potential harm. Principle 5 extends this protection to animals, plants and the environment.

The responsibility for honest and ethical research lies with individual researchers and their institutions. Institutions are responsible for governing research activity undertaken by staff members. In universities and other research institutions, an ethics panel or committee is convened at regular intervals during the year to assess the quality of research proposals and the risks they might pose to participants.

High risk in research means there is potential for significant harm to participants such as physical or psychological damage, loss of privacy (which can expose participants to scorn or victimisation), the release of data which can be misused, the loss of opportunity or advantage, or being deceived about the purposes of research (AVETRA, 2018).

Some groups of people are by definition categorised as 'high risk' (e.g. students under the age of 18) and special protections and considerations must apply before research involving these groups can be approved. Proposals posing high or reasonable risk require ethics approval before research can commence.

Low risk to participants in research means that the only foreseeable risk to them is mild discomfort (National Health and Medical Research Council, 2018).

However, researchers cannot make a judgement of what is, or is not, ethical research when people (or their data, or tissue, etc.) are involved. They also cannot decide if their research will pose low or high risks to participants.

Ethics approval must be gained from your institute for research that involves people, and there are specific criteria that apply to this research. Talk to your ethic approval team in the early stages of your planning to determine the level of risk your research might pose to participants and what you need to do to obtain approval from your institute.

More information about human and animal participation in research is provided in Attachment 4. Information on how to obtain approval for a research project is provided in Section 2.3 (p.30).

When planning an applied research project, your primary objective should be to enhance outcomes for participants (students, industry clients, teachers and/or other staff members). When doing applied research, always keep in mind three important indicators of integrity and ethics:

1. Honesty, integrity and frankness when undertaking applied research,
2. Treating people and animals involved in the research ethically and with respect, and
3. Acknowledging the work of others who make a substantive contribution to your research (see Attachment 8).

FURTHER READING

- The National Statement on Ethical Conduct in Human Research (2018)
- Australian code for the care and use of animals for scientific purposes (2013)
- AVETRA Research Code of Practice
- Guidelines for applications to conduct research in TAFE NSW
- National Health and Medical Research Council

2.2 PLANNING AN APPLIED RESEARCH PROJECT

An effective way to plan an applied research project is to write a research proposal. A proposal explains the problem you intend to investigate, why it is important to solve it, what is already known about the problem and importantly what is not known, the approach you will take to collecting and analysing data and how you will share your findings with others.

It also outlines logistical details such as timelines, resources and a budget. A good research proposal:

- Fits the mission, goals and objectives of your institute,
- Has a clear and strong argument for the need for research,
- Articulates clear research goals and objectives based on facts (not on personal goals),
- Shows you know something about the problem,
- Describes the methodology you will use to collect and analyse data,
- Explains how you will protect the privacy and welfare of participants (if required),
- Demonstrates that the objectives are attainable within your timeframes, research expertise and budget, and
- Ensures effective communication with clients (Walliman, 2011).

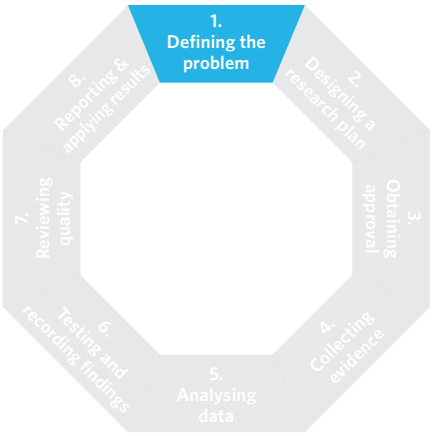
A research proposal is the document you will submit to the panel or committee in your institute responsible for approving and/or funding research projects. An example of a research proposal template and checklist is provided in Attachment 6.

However, your institute will have policies, procedures and forms to guide the application approval process. Make sure you obtain the right templates relevant to your institution when developing your proposal.

TIPS FROM THE EXPERTS

- Before you start writing a research proposal, check the field of research your proposed research fits in Australian and New Zealand Standard Research Classification.

2.2.1 DEFINING A RESEARCH QUESTION



Applied research in TAFE usually starts with a problem, idea or opportunity, unresolved issue or controversy, interest or perceived gap in knowledge identified by an industry or community client, teacher or other TAFE professional and/or students. An applied researcher turns the problem, idea or opportunity into a research question.

A research question is a concise statement that explains the problem or idea in a clear and plausible way. It also provides the focus for the applied research and a rationale for why it should be undertaken.

However, defining a research question can be a really challenging task, especially when a problem is ill defined or when there are numerous sub-problems. To formulate a good research question, it is helpful to:

- Be really clear about what the problem actually is,
- Set goals and objectives for your research, and
- Find out what others already know about the problem.

These steps are outlined below. As information comes in during this process, you may find your perspectives on the problem change and you need to adjust your question.

CLARIFYING THE PROBLEM

An applied research project typically starts with a discussion about a problem or idea and what might be a desired solution. During the discussion, it is important to determine broad parameters for a research project including timeframes, locations for fieldwork, budgets, potential funding sources and the people to be involved in the research team.

When negotiating a research project with a client, it is important to tease out their understanding of the problem, bearing in mind that you may be hearing one perspective on the problem or only hearing about the symptoms (Baimyrzaeva, 2018). If a client is unable to articulate a problem clearly, continue questioning to identify gaps in their knowledge and understanding.

A Project Request Form (a sample is provided in Attachment 5) can structure the meeting and help you to collect enough information to define a research project with realistic expectations.

After discussions with a client (or peers or students), decipher the information into a problem statement. A problem statement is just one or two sentences that describe the essence of the problem, the desired solution and the gaps in-between (that is the consequences of not resolving it). Examples of problem statements are provided in Table 1.

Make sure you communicate with the client and obtain their agreement on the final problem statement.

If your applied research project does not involve an industry client, the Project Request Form can be adapted to guide students planning an applied research project in a simulated industry environment or by TAFE staff members interested in researching a problem or idea within their institute.

If a problem is proving to be difficult to clarify, you can use problem-defining tools such as mind-mapping, storyboard and problem-tree analysis (Ibid.). Design thinking processes can be useful for clarifying complex and ill-defined problems.

TIPS FROM THE EXPERTS

> Other useful problem-solving tools such as Mindmeister can be found at www.creatingminds.org/tools/tools_defining.htm

> Not all applied research needs to answer a question or test a hypothesis and can be a more exploratory approach (Walliman, 2001).

> Try not to confuse problems with issues. Issues can be subject to various forms of interpretation such as global warming or homelessness (Baimyrzaeva, 2018).

> When formulating a research question, ask yourself:

- what issue is at the heart of the problem,
- why is it of interest to you (Willis, 2009),
- what relevant expertise do you bring to the subject (Walliman, 2011),
- what you are not going to do and why,
- what are you trying to achieve from the research (Barratt-Pugh), and
- what are you going to produce?

> Don't make the research questions too complex or the problem too big. Keep things in perspective (see Table 1 below).

SETTING GOALS AND OBJECTIVES

A problem statement provides a base to set goals and objectives for your applied research project. A research goal states what you (and/or your client and students) want to achieve from the research.

Research objectives are written as action statements that explain how the goals will be achieved (Table 1).

Research goals and objectives will help you frame your project, communicate with a client, find information relevant to the problem and stay on track during the research process.

They are not set in stone and can be adjusted as new information comes in.

PROBLEM STATEMENT	RESEARCH GOAL	RESEARCH OBJECTIVES
Example 1 A Wheelchair Hockey League seeks to develop specialized hockey equipment for quadriplegic players who have little or no upper body movement and play with their hockey stick taped to the side of their chair. This practice limits their playing potential and causes injury when the sticks fall from a chair during a game.	Develop a prototype hockey stick that enables quadriplegic players to play to their potential and reduces the risk of injury.	1. Identify the specialised needs of quadriplegic hockey players in the Wheelchair Hockey League. 2. Identify gaps in the performance of existing hockey sticks in relation to these needs. 3. Develop a prototype that meets the needs of quadriplegic players.

[15] Google Scholar and the VOCED Plus database are terrific sources of information and leads to other relevant work

PROBLEM STATEMENT	RESEARCH GOAL	RESEARCH OBJECTIVES
Example 2 FashionFuture Institute is Victoria's premier training provider for the clothing and footwear industry. However, the level of employer satisfaction with graduates is falling, which threatens the institute's premier status and impact on student numbers if course outcomes are not improved.	Better align fashion design courses at FashionFuture Institute with the competencies graduates need for successful employment in Victoria's premium clothing and footwear industry.	1. Identify core competencies for successful employment in Victoria's premium clothing and footwear industry. 2. Identify gaps between core competencies and outcomes of current fashion design courses. 3. Determine strategies to incorporate new competencies in course design and delivery.

Table 1: Examples of applied research goals and objectives

FINDING OUT WHAT OTHERS KNOW ABOUT THE PROBLEM (DOING AN ENVIRONMENTAL OR LITERATURE REVIEW)

It is highly likely that other people have undertaken research into the problem you want to investigate (or a problem similar to it). You can find this information in a range of places including academic literature (books, academic papers, conference papers and journals), government and industry reports, media articles, market and technical reports, discussion papers and submissions, archival material and websites[15].

You can also talk to people who know something about the problem and can point you in the direction of further information.

As you find and read sources of information, write short summaries of information that is relevant to your research and organise the summaries into a body of notes.

The aim here is to produce a written environmental (or literature) review that will form an important part of your research proposal and final report, paper, presentation, artistic work or performance at the end of your research.

A short guide to writing an environmental review and checklist is in Attachment 7.

An environmental review prevents you from wasting time and effort duplicating existing research and can assist you to surface any assumptions that you, your industry clients and /or students may have made about the problem. As you read, note how other researchers went about their research in your field, how they developed and articulated their ideas and research question.

Also look for theoretical concepts and methodologies they used, inconsistencies in their findings and areas in your field that need further investigation. This information will form the argument for your research in your research proposal.

Make sure you check that each source of information is credible and written in the last 5-10 years or so. Older information is acceptable to use when it is a landmark study in the field (such as Ernest Boyer's 1990 work on scholarship in this Guide) or it is highly relevant to your research question.

Accurately record sources of information as you read to avoid confusion when you are writing a report and prevent the potential for plagiarism or infringement of copyright law. Details of referencing and citation styles are provided in Attachment 8.

An environmental review is commonly written in report format which includes an introduction, body of text, conclusion and list of references. A good environmental review is not a summary of what you have read but a critical discussion of what is known about the problem, the main controversies in the field and information that is yet to be discovered to resolve it.

Your environmental review will be draft at this point, which means you will be able to develop and refine it as you progress through the applied research process.

TIPS FROM THE EXPERTS

> Visit your institute's library or the Victorian State Library for advice on where to find the information you need (for more information see Attachment 12).

> Look closely at how others in your field have written their environmental review.

> Revisit your research goals and objectives in light of what you learn during the review.

> Consider using an electronic referencing system such as EndNote.[16]

> Make sure you know a bit about the problem before you talk to experts in the field (Baimyrzaeva, 2018).

FORMULATING A RESEARCH QUESTION

You should now have enough information about your problem to formulate a research question. This is simply a matter of turning your research goal into a question and your objectives into sub-questions.

The main research question sets the focus, context and parameters for your applied research and makes an abstract claim about the problem (Walliman, 2011). The sub-questions break the main question into smaller and more manageable parts of narrower focus. Examples of research goals and objectives converted into questions and sub-questions are provided in Table 2.

RESEARCH GOAL	RESEARCH OBJECTIVES
Example 1 Align fashion design courses at FashionFuture Institute with the competencies graduates need for successful employment in Victoria's premium clothing and footwear industry.	How can FashionFuture Institute better prepare fashion design graduates for successful employment and careers with premium clothing and footwear employers in Victoria?
APPLIED RESEARCH OBJECTIVES	RESEARCH SUB-QUESTIONS
1. To identify core competencies fashion design graduates need for successful careers in Victoria's premium clothing and footwear industry.	1. What graduate competencies are most important to premium employers in the Victorian clothing and footwear industry? Why?
2. To identify gaps between core competencies and the competencies FashionFuture Institute's fashion design courses currently offer.	2. Which of the core competencies identified by employers are delivered in FashionFuture Institute's fashion curriculum and which are not?
3. To determine strategies to improve FashionFuture's Institute's fashion design courses in relation to core competencies.	3. Where do gaps in competencies exist in current curriculum and delivery models and how can they be addressed?

[16] www.endnote.com/

RESEARCH GOAL	RESEARCH OBJECTIVES
Example 2 Develop a constraint management framework to improve the management of large construction projects.	How can major constraints to large construction projects be more effectively managed?[17]
APPLIED RESEARCH OBJECTIVES	RESEARCH SUB-QUESTIONS
1. Provide a comprehensive review of the constraints typically found in large construction projects.	1. What are the major constraints affecting the management of large construction projects?
2. Review current constraint modelling practices in the construction industry and identify best practice.	2. What are effective constraint modelling practices for large projects in the construction industry?
3. Develop a constraint classification method for easier constraint identification and modelling.	3. How can these constraints be classified for easier identification and modelling?

Table 2: Converting goals and objectives into research questions (adapted from Baimyrzaeva, 2018)

As already suggested, take care not to make your research question too broad. Questions that are too broad not only make it difficult to plan and implement a research project, they can threaten the integrity and validity of your findings. The question in example 2 is currently too vague and can be further refined. Examples of how to refine research questions are provided in Attachment 9.

[17] This research question is further refined in Attachment 9.

2.2.2 DESIGNING A RESEARCH METHODOLOGY

A research methodology is the blueprint that will help you to collect the right information to answer your research question. Designing a research methodology usually involves:

> Choosing a theoretical or conceptual framework,

> Deciding a research design,

> Specifying what data to collect, and

> Selecting appropriate methods to collect and analyse the data.

Different research problems require different methodologies depending on the subject of an investigation.

CHOOSING A THEORETICAL OR CONCEPTUAL FRAMEWORK

The first step in designing a research methodology is considering a theoretical or conceptual framework to guide your study. A framework will help you to explain why the research problem exists and also predict how you might solve it. While not all applied research uses theory, theory is important because theoretical knowledge underpins all professional disciplines, either explicitly or implicitly (Bickman & Rog, 2009).

Engaging in theory can be one of the most challenging aspects of research because it requires you to select a theory appropriate to your research question and your worldview and then explain how it applies to your research problem.

The good news is that not all applied research projects need a theory and not all applied researchers are interested in using theory for their research.

You can choose instead to opt for a simple conceptual framework which is described further below. However, it is still important to understand the role of theory in research because a theory guides a researcher to look at a problem in a certain way and provides a starting point for further research, testing or experimentation.

A theory can be a concrete law or set of laws (such as the law of gravity or laws of mathematics) or a less formal and speculative explanation of a problem and how it might be solved. In its simplest form, a theory provides a statement about the subjects of research (or parts to be investigated known as variables) and how they relate to each other.

For example, the teacher in case study 5 used three recognised forms of learning in VET (formal, non-formal and informal learning) to frame her study and explain her findings.

A theoretical framework introduces and explains a theory and its relationship to a research problem. A conceptual framework is a logical guess that specifies the key variables and their relationship to each other (Baimyrzaeva, 2018).

For example, a simple conceptual framework for the question posed in Table 3, 'How can FashionFuture Institute better prepare fashion design graduates for successful employment and careers with premium clothing and footwear employers in Victoria?' might be:

Core competencies for FashionFuture Institute graduates = the specific skills, knowledge and attributes identified by premium Victorian employers as being essential for successful employment in the textile and fashion industry.

You may have identified a theory of interest during your environmental review. If not, and you are interested in choosing a theory for your research, it is best to obtain the advice of a mentor at this point.

If you choose to develop a conceptual framework, it can be useful to make a diagram of what you think the variables in your research question are and the possible relations between them.

TIPS FROM THE EXPERTS

> Consult with your mentor to discuss a conceptual or theoretical framework for your research.

> Look for theories and concepts as you read other peoples' research.

> Follow up with background reading about research theories in recommended research texts.

> Be aware that a conceptual framework will probably declare any assumptions you might have made about your research problem (Barratt-Pugh).

FURTHER READING

> For a simple summary of research theory and methods, see Nicholas Walliman's (2011) e-book, Research Methods the Basics , pages 15-28.

> See the AVETRA website: AVETRA resources for VET researchers

DECIDING A RESEARCH DESIGN

A research design is the practical frame that holds all the components of research together. Your choice of design will depend on your research question and objectives; that is what you intend to do.

For example, are you planning to explain or describe an event or problem, predict what might happen, increase understanding and knowledge about a phenomena, evaluate an event or program, test a product material or service, experiment with a new idea or improve your professional practice.

There are many research designs to choose from (such as descriptive, narrative, comparative, experimental, evaluation, action, case study, ethnological and cultural research designs). Different research designs are explained in Attachment 10.

You might for example, want to test how well a material or product performs in different environmental conditions.

You could choose an experimental design for this research. Alternatively, you might want to investigate why a social problem is occurring in a specific context. A case study or narrative research design could be suitable.

A narrative research design was used in case study 5 to capture the lived experiences of Aboriginal VET students in a remote community. If you want to investigate a problem in your workplace, you might use an action research design. You can choose more than one design to suit different parts of your research project.

An important question to ask at this point is if your research will be a qualitative or quantitative design or a mixture of both.

Quantitative research uses data that is measurable (that is numbers or amounts of a phenomena) and draws on logical or statistical observations to draw conclusions.

Case study 7 (testing the effects of air leakage on energy use, air quality, comfort and durability in extreme cold climates in Manitoba, Canada) could have been a quantitative study.

Qualitative research investigates phenomena relating to human behaviour using data that is not measurable, such as data obtained from listening to people or observing behaviours. Case study 5 is a qualitative study. Qualitative research is usually less structured than quantitative research and allows for concepts and theories to emerge during the research process.

The important point about the two modes of research is that they use different methods and techniques to collect and analyse data (Table 3).

QUANTITATIVE METHODS	QUALITATIVE METHODS
> Tests (e.g. R&D testing or testing structural integrity of building materials), > Experiments and simulations, > Questionnaires and surveys (when data can be measured), > Structured interviews (responses are measurable), > Desktop review contained numerical analysis.	> Questionnaires and surveys (open-needed questions), > Unstructured and semi-structured interviews, > Focus groups, > Observations, > Desktop review, > Narratives, > Visual methods, > Case study.

Table 3: Examples of quantitative and qualitative data collection methods

Applied research generally utilises a mixture of both methods, which is called a 'mixed methods' design. Mixed methods designs cross the qualitative-quantitative boundary and were probably used in most of the case studies in section 1. However, as a quantitative study, case study 7 may have used experiments and simulations to collect data and statistical or mathematical techniques for analysis.

Case study 5 used qualitative techniques such as interviews and narratives to capture and analyse people's opinions, values, feelings and experiences.

SPECIFYING WHAT DATA TO COLLECT

Before selecting your research methods, you need to specify the type of data you need to reliably answer your research question. This process is called 'sampling' and the field you are sampling from is called a 'population'. Sampling is important because it allows you to obtain data from a representative sample without having to collect data from a whole population.

A sample unit is the 'who' or 'what' you are investigating within that population. This might be a social unit (family, employer, or cohort of students), a technical or geographical unit (town, city or state) for example. A sample size is the number of units you are planning to collect data from.

As a rule, larger sample sizes are more reliable than smaller sizes.

Data collected for the first time that is original to you is called primary data. Examples include information collected from surveys, interviews, focus groups, observations, test results, measurements and experiments undertaken during your research.

Data obtained from other peoples' work (such as academic papers, statistical data from the Australian Bureau of Statistics or the NCVER, industry reports or a client's archival data) is called secondary data.

There are two recognised sampling techniques:

1. Probability sampling – which uses random methods to select sample units but tries to make sure that each unit has an equal chance of selection. This technique is mostly used in quantitative studies, and
2. Non-probability sampling - uses non-random methods to select the sample units and relies on the judgement of researchers. This technique is more common in qualitative studies (Willison, 2011).

A simple table can assist with the identification of data, where you might find it and suitable methods to collect it (Table 4).

RESEARCH SUB-QUESTION	WHAT DATA DO I NEED? (DATA TYPE)	WHERE DO I FIND IT? (SAMPLE UNIT)	HOW DO I COLLECT IT? (METHODS)
What core competencies do premium employers in Victoria's clothing and footwear industry want in graduates?	> How many premium employers are there in Victoria, > Who are they? > Skills, knowledge and capabilities required of fashion design graduates.	> Industry reports > Employers views > Graduates views > Training Packages	> Desk-top review > Survey > Interviews > Focus groups > Observations

Table 4: Identifying data sources and research methods

An important concept to remember when sampling is the principle of triangulation. Triangulation means using a variety (more than one) method to collect data so that the results of research are not skewed or otherwise made invalid. You also need to collect data form a variety of sources. For example, an applied research study into a problem affecting the quality of life of aged care residents may need data from a range of sources including media, government and industry reports, aged care facility management (performance reports and statistics, policies and procedures), aged care practitioners and residents themselves. Data obtained from management alone or using one method (such as survey) may not reveal the full extent of the problem and the lived experiences of residents and practitioners.

TIPS FROM THE EXPERTS

> When sampling quantitative data ask, 'what will I be measuring and how will I measure it?'
> Choose extra sites to collect data just in case some units withdraw from your project.
> For more information on qualitative research methods see Given (2008), The SAGE Encyclopaedia of Qualitative Research Methods

SELECTING RESEARCH METHODS AND INSTRUMENTS

When selecting research method and instruments, remember that quantitative methods provide the big picture of a problem and qualitative methods bring finer detail and human perspectives to your research. This means that 'mixed methods' can often be the best approach. However, each method will require specific data collection instruments.

For example, observations will require an observation recording form and perhaps visual and verbal recordings. A survey can be manual or electronic. Interviews can be structured (where the interviewer uses standardized questions), unstructured (where the interviewer explores beyond pre-determined questions) or a combination of both types (known as semi-structured interviews).

All research instruments have protocols to guide their development and use. Before finalising your choice of methods and instruments, it is important to consider:

1. Their suitability to the participants in your research. For example, if investigating a learning problem related to students with low levels of English language, you would not select a written survey and may choose to interview them instead,
2. The order you will use the methods. For example, a desktop review can be useful for preparing interview questions or technical experiments, while a focus group can inform the development of effective survey instruments,
3. Ethical issues related to the research methods. For example, you may need to obtain consent from participants for an interview or focus group and have a record of that,
4. The resources you will need (interview rooms, digital voice recorders, testing laboratories, measuring equipment, computer programs etc.),
5. Access to research sites (some sites require authorisation or may not allow entry), and
6. The balance between quantitative and qualitative methods when using a mixed method design.

As you select research methods and instruments, consider how you will analyse your data. To analyse quantitative data, you can use one of many statistical methods to make numerical comparisons, forecast, test a hypothesis or make a judgment of probability.

Software such as SPSS and other packages will do much of the analysis for you but you will need to identify the concepts, variables and measurements for your research beforehand and understand how the various tests function in relation to your research question. An Excel spreadsheet is a simple way to collect and analyse numerical data and present the results in graph format.

Qualitative data can be analysed by looking for patterns and themes in what people say or do in relation to a particular event or situation. Content analysis for example can be used to examine documents, publications and film and radio programs. Remember that data analysis does not occur once but is an iterative process undertaken during data collection.

TIPS FROM THE EXPERTS

> Consult with your mentor when selecting research methods and instruments.
> Read recommended research textbooks for further advice.
> Pilot your data collection instruments with your peers or a small sample of the target group for the survey to check for ambiguous wording, repetition or confusing phrasing and missing information.

FURTHER READING

> AVETRA resources for VET researchers
> SAGE Handbook of Qualitative Research (2017) edited by Denzin and Lincoln.
> Robert Yin's book, 'Case Study Research: Design and Methods' (6th ed.) published by SAGE Publications, 2017.
> Survey Monkey for the design of web-based surveys and tips on writing survey questions.
> Guides to developing and conducting interviews can be found at: www.sociology.fas.harvard.edu/files/sociology/files/interview_strategies.pdf and www.indianscribes.com/preparing-qualitative-research-questions-for-an-interview/
> Ask your librarian if your institute has access to SAGE Research methods at www.methods.sagepub.com/Cases

2.2.3 DEVELOP A PROJECT SCHEDULE

The final task in the planning process is writing a schedule to plan and monitor your applied research activities. A schedule outlines:

- A program of work,
- The resources you require to complete the research activities including:
  - People involved in the research and the project, and
  - Materials, equipment and facilities,
- A budget for the project (how much will it cost and how will it be funded),
- A communication plan (for industry clients and research partners), and
- A risk management plan.

Risks to a research project could be a small sample size that does not produce enough evidence to draw reliable conclusions, a low budget and short time frames, potential conflicts of interest, the potential loss of key research personnel or the loss of funding. You need to explain each risk and how you would introduce appropriate mitigation strategies.

FUNDING FOR APPLIED RESEARCH

Sources of funding for applied research projects in TAFE include:

- Project grants and scholarships allocated within a TAFE institute or dual sector university,
- Funds provided by an industry client in part or in full,
- Grants provided by industry associations and groups, and
- Victorian Government grants available through the VET Development Centre.

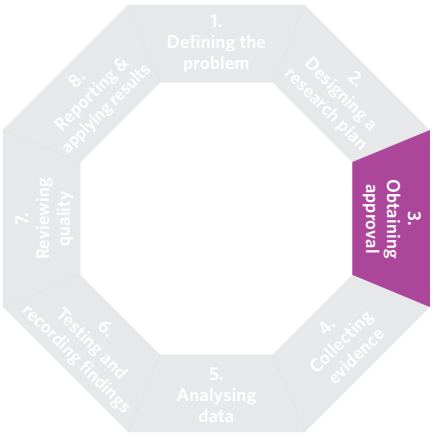
Where applied research projects involve partnerships with universities, applications for funding through the Australian Research Council (ARC) may also be considered.

Almost all funding bodies and sources provide clear information on the areas or subjects they are interested in funding and the conditions and objectives of funding.

Applications need to address a valid problem or concern within their areas of interest and prove that the research is feasible, is cost effective and will use valid and reliable research methods and techniques.

Always check the conditions for funding thoroughly to avoid wasting time and effort writing ineligible applications.

2.3 OBTAINING APPROVAL



When you have finished writing your research proposal, check it is complete before submitting the final version for approval by your institute.

Research in TAFE generally cannot proceed until approval is granted by an institute and the industry client and/or funding authority when applicable.

2.3.1 APPROVAL PROCESSES IN TAFE

TAFE institutes and dual sector universities generally have well-established processes to assess the viability of research projects.

Some have an ethics panel or committee responsible for granting approval for research projects.

To obtain approval, applied researchers need to submit their research proposal.

If people and/or animals are involved in the research, the committee may also want to view:

- Copies of letters that explain your research to people participating in the research,
- Forms that obtain consent from participants,
- Protocols you will use when dealing with participants during the research process (for example how you will conduct interviews, focus groups or observations),
- How you will ensure the safety of human and animal participants, and
- How you will adhere to data privacy, storage and disposal regulations.

Most applied research projects conducted by TAFE institutes for industry partners do not require ethics approval but may need approval to proceed with fieldwork.

Always check your local institute's requirements before proceeding.

FURTHER READING

- TAFE NSW's Guidelines for applications to conduct research in TAFE NSW and Code of Conduct and Ethical Practices
- Humber College, Toronto Canada for an example of the policies, procedures, guidelines and forms applied researchers need to follow to obtain ethics approval.
- AVETRA resources for VET researchers

2.3.2 CONTRACTUAL ARRANGEMENTS WITH INDUSTRY

Applied research projects undertaken for industry usually require a contractual agreement to protect the confidentially of business information and ownership of IP.

IP refers to creative assets created by the research project with market value (such as inventions, literary and artistic works, designs and symbols, images and publications, technical information, prototypes, software, multimedia materials, photographs and curriculum and teaching materials).

Two types of IP are considered:

1. Foreground IP created during the applied research process, and
2. Background IP that is pre-existing information provided by either party during research.

In Canada, colleges and institutes generally do not claim ownership of IP of applied research projects and grant royalty-free commercial rights to their industry partners. However, applied research agreements allow colleges and institutes to use the results of applied research for academic purposes.

This allows staff or students to publish their research, or reference research projects in their resumes. However, they are required to complete a confidentiality agreement for the duration of the research project.

Contractual agreements and memoranda of understanding (MOUs) specify how students will be involved in a research project, the expectations of teachers and students when operating in a client's workplace, and the roles and responsibilities of all parties involved in the research process. When complete, a contract is signed by a delegated authority in TAFE and in the client's organisation.

Be aware that approval from both authorities does not always mean you have permission to access research sites or will have the cooperation of participants. Also be aware that the results of applied research are not always positive or will meet a client's expectations. When this occurs, applied research can produce new and unexpected innovations but can also result in failure.

FURTHER READING

> The Australian Government website,
> IP Australia and
> the Australian IP Toolkit for Collaboration

SECTION 3: IMPLEMENTING A RESEARCH PLAN

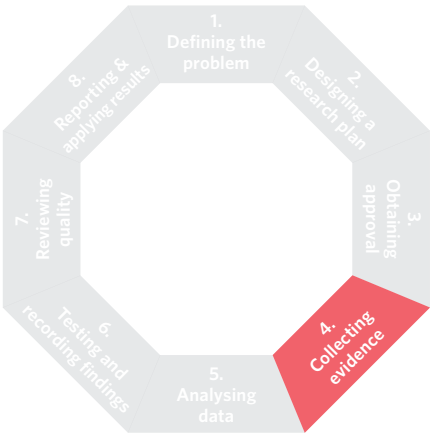
WHAT YOU NEED TO KNOW

> Implementing an applied research plan involves collecting, preparing, analysing and interpreting data.

> Data analysis involves coding information into main themes in qualitative studies or numerical data sets in quantitative studies.

> Applied research is not complete until findings are communicated to an audience.

3.1 COLLECTING EVIDENCE



Once your applied research project is approved, you can start preparing for fieldwork.

Depending on your research methodology, this may involve setting up tests or experiments, sending letters to participants to obtain their consent to participate, scheduling interviews, focus groups or observations, designing surveys, arranging the participation of students and so forth.

When preparations are complete, you are ready to start collecting and processing data.

As you collect data, write field notes while details are fresh in your mind. Field notes can be transcripts of interviews and focus groups, observations of people, testing of equipment or materials or initial trends in survey data.

Add insights in memos or comments to your research instruments as you go and keep a critical eye on the type and amount of evidence you are collecting (raw data).

You will need to collect and store data securely to ensure that you protect IP and the anonymity of information sources. You can use pseudonyms to protect the identity of participants, especially if you quote them.

You will need to retain the original data for a required period of time to allow your analysis to be reviewed, if required, so make sure you check your Institute's policies on data collection and retention.

When you have completed a data collection activity, check that the instrument you used is complete, legible and accurate before entering data into software or filing it away for future reference and analysis. It can be easy to forget to record a response during an interview or record figures in a test incorrectly.

If this happens, you may need to go back to the source and correct the information in the instrument. Sending transcripts of interviews and focus groups to participants is an effective way to verify the accuracy of qualitative data.

The checking process is known as 'editing' or 'cleansing' data and is an important part of data processing. Data processing starts with the collection of raw data, which is then edited, coded and analysed (Figure 6).

Note the different processing activities for qualitative (orange) and quantitative research (green) methods. Editing in this context means tidying up; it doesn't mean changing data or removing data that you don't like or that doesn't support your hypothesis.

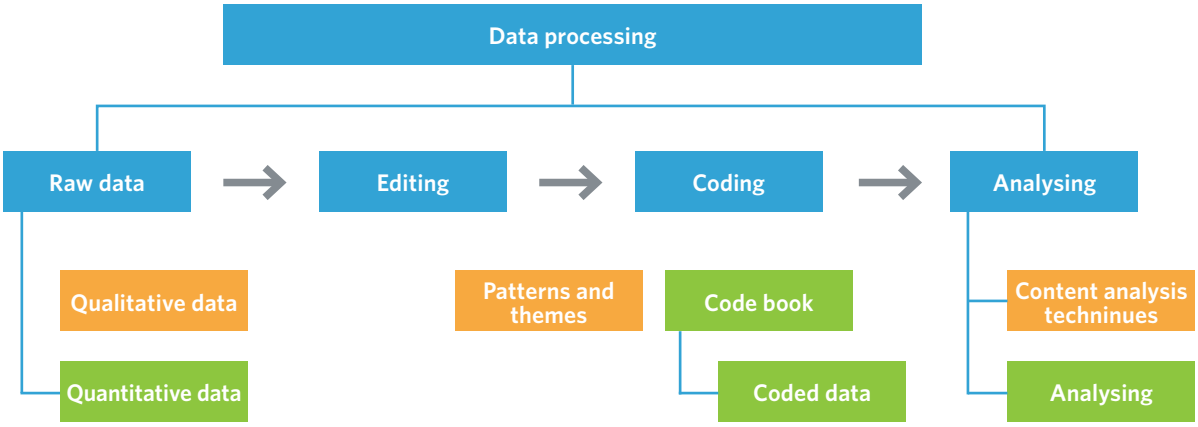


Figure 6: Steps in data processing (adapted from Kumar, 2011)

Coding means sorting data into manageable chunks, which makes it easier to store and retrieve it for further analysis.

The practice of collecting, sorting and analysing data at the same time is more common in qualitative research. Coding qualitative data involves looking for themes or categories in common such as a similar attitude towards a problem expressed by participants.

Once a theme or category is identified, a code is assigned using key words or numbers (or both). Codes are not set in concrete at this point and can change as more data comes in. Be careful not to jump to early conclusions, or reject or distort evidence based on limited amounts of data.

Coding quantitative data involves transforming data into numerical values using a codebook. A codebook sets rules for assigning codes, which might be temperature, pressure, number of responses or demographic information.

As you code data, you need to consider if you have collected enough data to reliably answer your research question.

TIPS FROM THE EXPERTS

> If you are using qualitative methods to collect evidence, look for direct quotes from participants that you can use to highlight key points in your research.

> AVETRA resources for VET researchers

3.2 ANALYSING DATA

When you are satisfied you have enough data and have finished coding, start interpreting what the data is telling you about your research question.

When analysing quantitative data, you will be measuring and making comparisons, examining relationships, making forecasts or testing a hypothesis. Quantitative analysis can be an iterative process of testing, obtaining feedback from users or clients and re-testing using a mathematical frame of analysis.

This can be done manually if there are a small number of respondents and not too many variables to measure.

However, electronic survey and statistical analysis programs are more expedient and accurate in their calculations, depending on the quality of data. Graphs and charts are an effective way to communicate the results of quantitative analysis.

A number of the packages you might use for this purpose, for example Survey monkey and Qualitrics can be useful to facilitate what data analysis you want to do.

When analysing qualitative data, look for patterns or themes in the data until you reach saturation point (that is when themes keep recurring).

Content analysis techniques are useful for identifying themes in interview transcripts, observational field notes and other qualitative instruments. When you reach saturation, start analysing what each theme means, why it is occurring, what is that telling you about your research question and what further information you might need. Raise the analysis up a level by comparing patterns in themes or grouping themes together under broader headings.

A table can assist you to identify themes in qualitative data and relationships between them (Table 5).

As you analyse data, visualise how you can best present your findings to an audience. Images, diagrams, text and direct quotes from primary data, and/or key information, quotes or theories from secondary data can illustrate your findings.

Remember though that not all findings will be clear-cut or easy to represent in this way.

THEME	EVIDENCE	PRIMARY LOCATION	DEFINING CHARACTERISTICS	RELATIONSHIP WITH OTHER THEMES?
What is the issue/ theme?	What is the evidence to support it? For example: • Quotes • Pictures • Graphs etc.	Where did you find it? For example: • Interview • Focus Group • Experiment • Survey etc.	What defines the theme and separates it from others?	Which other themes are related? How are they related? How strong is the relationship?

Table 5: Identifying key themes in qualitative data (adapted from Barratt-Pugh)

When you have completed your analysis and drawn your conclusions, carefully review the logic behind your findings and ensure that they actually address your research question.

If not, you may need to obtain more information or amend your research questions in consultation with your client. Any changes to the research question and /or methodology will need to be explained in your final report, presentation or performance.

This is a good time to review if your research meets the OECD's (2105) criteria for R&D (novel, creative, uncertain, systematic and transferable or reproducible) and the principles of research; honesty, rigor, transparency, fairness, respect, recognition, accountability and responsibility).

Applied research does not have to break new ground, but it should extend knowledge in a field in a useful way. Alternatively, it may actually refute existing knowledge.

If an industry or community client has requested recommendations as part of the research outcomes, formulate practical and feasible recommendations for each research finding and explain how and why your client should implement each one (Baimyrzaeva, 2018), again bearing in mind the principles of research.

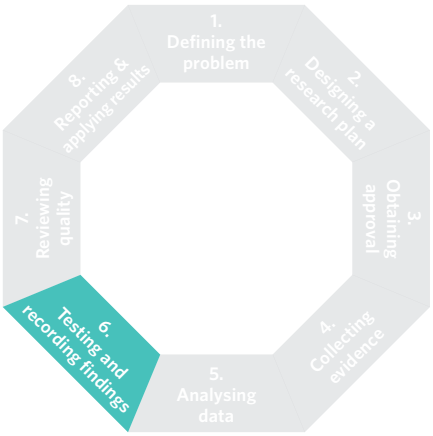
TIPS FROM THE EXPERTS

> Step away from the data every now and then to allow time to clarify your thoughts during the analysis process.

> Test your findings and feasibility of recommendations with peers (within confidentially agreements).

> Make your recommendations clear and hard-hitting.

3.3 DOCUMENTING FINDINGS



The final activity in the implementation of applied research involves organising your findings into a format that can be shared with others.

This might be an article, report, academic paper, guide, conference presentation, program, new product or process, performance or artistic work accompanied by explanatory text.

The findings of applied research are usually conveyed through text and/or presentations.

However, an industry or community partner may prefer an oral report of findings (to a meeting or industry conference) or a summary document presented to an industry-TAFE working party.

WRITING REPORTS, PAPERS AND PRESENTATIONS

At this stage, you will have a draft environmental review, a summary of your data analysis and a range of ideas to present your findings, which now can be brought together into a final report, paper or presentation.

These do not just repeat your raw data but should provide a critical analysis of a problem and well-evidenced, applicable and transferable ways to solve it (or not).

A qualitative research report is written in a descriptive or narrative style using observations, quotes from participants and graphs, diagrams and matrices to represent key findings.

A quantitative research report is written in a more technical style using graphs, tables and diagrams to relay the findings. A report on a mixed methods study would use a mix of these two reporting styles. The components of a research report are outlined below (Table 6).

	Choose a title that is simple, catchy and accurately reflects your research question.
EXECUTIVE SUMMARY	A one-page summary of what you did and what you found. Reduce this to 2-3 paragraphs for an abstract (academic paper).
ACKNOWLEDGMENTS	You might need to thank funding bodies or colleagues who have provided assistance.
TABLE OF CONTENTS	A list of titles or parts of a research input (such as a book or article) shown in the order in which the titles/parts appear.
INTRODUCTION	A brief description of the research problem, goals, objectives and methodology. Start by describing why the problem is significant and why it needs to be solved. Follow with the rationale and background to your research and goals and objectives, pointing out limitations to the study and deviations from the original research plan. Conclude with a summary of findings and recommendations and an overview of how the report/ paper is structured.
ENVIRONMENTAL REVIEW	Describe the context for the applied research (industry and population) and previous research in the field (this can also be included in the introduction for a report). Use the most relevant and important information you find and close with a summary of key points, what needs further investigation and your research questions.
METHODOLOGY	Detail the purpose of your study, the methodology, ethics approval (if required), sampling strategy and methods used to collect data and who participated in the research (within confidentiality constraints). If writing a report for a client, you can provide this information as an attachment to your report.
DISCUSSION	Discuss your findings in relation to the research questions with implications for the client (if applicable) and recommendations for implementation. You can structure this section according to the research questions or key themes in the data. If you use comparative case studies, include a section for each case study and add an additional section to discuss the findings.
CONCLUSION AND RECOMMENDATIONS	Tie everything together in your conclusion to answer the research question/s. Start by briefly summarising the research and conclude with the contributions the study makes to your field and recommendations for further research.
SHORT REFLECTION	Reflect on how you could improve the applied research process and build capability as an applied researcher.
REFERENCES	Make sure you use accepted referencing and citation styles.
ATTACHMENTS	Include what is needed to help readers and users to see how you have reached your conclusions. You do not need to include all data collected.

Table 6: Components of an applied research report

Make sure that you keep the chapters in the main body of the report short, concise, clearly written and focused on the analysis and move less important relevant details to attachments.

If you use acronyms in your document, you may need to add a glossary of terms after the table of contents or as attachments and always check you have correctly cited and referenced sources in your report. As you write, ask yourself:

- Do my paragraphs connect and flow logically from one to the other,
- Are my arguments strong enough to convince the reader,
- Have I adequately answered the research questions and sub-questions,
- Have I repeated examples, quotes and results in text or illustrations in the report (try not to do this),
- Do my conclusions tie the report/paper together,
- Will my findings stand up to scrutiny from peers or industry experts, and
- Objectively, how well can I defend my applied research findings should they be challenged?

Take care with language and how you express ideas and technical concepts to readers to make sure they can understand what you are saying. It is good practice to clarify technical terms and phrases in text or in a footnote or glossary of terms for the reader to reference. For example, an international reader might not understand specific acronyms or technical or industry terms used in Australia.

Avoid stating indisputable facts or claims in your report or paper. Most researchers avoid doing this by expressing their findings in uncertain or more cautious terms such as,

- 'The data suggests. . .' or,
- 'It is likely that. . . '.

They also use phrases such as, 'At the time this study was undertaken. . .' to allow for changes in the research context or problem that might occur after their study is published.

Researchers also avoid phrases written in the first-person (such as I or we) and highly subjective or colloquial terms (such as wouldn't, couldn't or don't).

When preparing presentations for an industry client or a conference:

- Start with an opening statement that describes the problem and the consequences of not resolving it. This should capture audience attention and could be a question or provocative or amusing statement,
- Follow by stating the purpose of your research and brief overview of the research question and how you went about the research,
- Spend most of the time describing your key findings leaving finer details for discussion after the presentation. Use examples to illustrate your points, and
- Summarise the main points and recommendations, explaining the implications of implementation (Baimyrzaeva, 2018).

TIPS FROM THE EXPERTS

- Write clearly and simply! Think of your audience.
- Try not to present too much detail in your report/paper or presentation or readers will lose the thread of your research.
- Use pictures, tables and graphs to break-up large amounts of text and serve as quick point of reference.
- Make sure tables or diagrams clearly identify the data they contain.
- Use a metaphor to convey the main point of your research but take care not to distort or misrepresent it.
- When presenting, give people time to contemplate what you have said and to formulate a question. It may seem awkward to wait for someone to raise their hand, but sometimes it takes people a few minutes to process all the information you present.

FURTHER READING

- Ranjit Kumar's e-book, Research methodology: a step-by-step guide for beginners (2011)
- The University of Technology's tips on academic writing
- AVETRA resources for VET researchers
- NCVER Guidelines for presentations
- The University of Technology Sydney (UTS) has useful tips on presenting at conferences

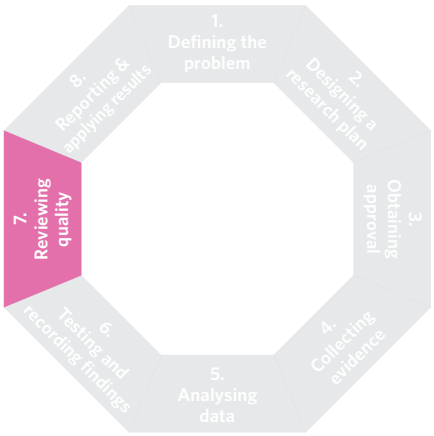
SECTION 4:
SHARING RESULTS

WHAT YOU NEED TO KNOW

> It is important to obtain feedback on the applied research process and the validity and reliability of findings through peer review.

> Self-reflective critique is an essential to quality applied research practice and to building research capability.

4.1 REVIEWING QUALITY



Before sharing the results of research, it is essential to obtain feedback on the quality, validity and reliability of your research from peers and/or industry clients.

PEER REVIEW

Peer review (or expert review) can highlight the strengths and shortcomings of your research that may not be obvious to you.

It also strengthens the reliability of your findings, the quality of your report and your confidence as an applied researcher.

Peers can be industry practitioners (depending on confidentiality agreements with clients) or teachers (VET or HE) who have sufficient research experience to give constructive feedback. A series of questions based on Glassick, Huber and Maeroff's (1997) quality standards for scholarly practice can be used to guide the review process (Table 7).

These full standards are provided in Attachment 11.

QUALITY STANDARD	QUESTIONS FOR A REVIEWER
1. Clear goals and well-defined purpose	• Is the purpose of the research stated clearly? • Are the research goals and objectives realistic and achievable? • Are important questions in the field identified?
2. Adequate preparation	• Has the author demonstrated a good understanding of existing knowledge in the field?
3. Appropriate methods	• Are the research methods appropriate to the goals and objectives? • Are the methods effectively applied?
4. Significant results	• Does the research contribute new knowledge to the field? • Are additional areas for further applied research identified?
5. Effective communication	• Is the research report well organised and presented? • Are the research messages valid and clear and presented with integrity?

Table 7: Sample questions for external reviewers (adapted from Glassick, Huber and Maeroff, 1997)

In addition, you can ask external reviewers for other feedback they would like to provide.

If your applied research is subject to confidentiality agreements, you may not be able to obtain peer review.

However, you can obtain feedback from your client before finalising your report.

REFLECTIVE CRITIQUE

Taking time to reflect on the errors, muddles, roadblocks and oversights experienced during the applied research process will improve your applied research knowledge and practice.

Reflective critique is an important part of experiential learning and continuous improvement in research. Glassick, Huber and Maeroff's (1997) quality standards can also guide the reflective process.

You can also use Beddie and Simon's (2017) Applied Research Developmental Framework for VET to monitor and assess your development as an applied researcher in TAFE.

Focus on continually developing knowledge and capabilities in:

> Research methodology, methods, techniques and processes,

> Communication (writing, interviewing, presenting and using digital platforms),

> Organisational skills (planning, contract and project management and writing grant or funding applications), and

> Modelling applied research skills and capabilities to students.

TIPS FROM THE EXPERTS

> Do not blame a reviewer if they misunderstand or misinterpret your research. This means you may need to revise your report. Be respectful if you disagree with a reviewer's comment.

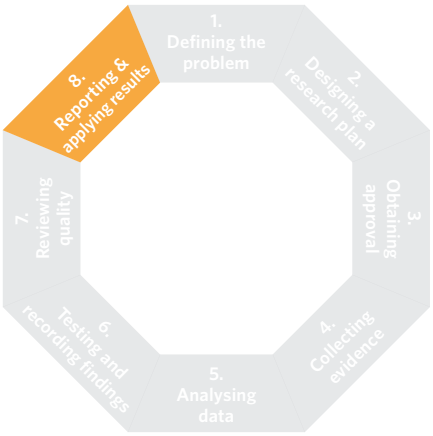
> As you reflect on your applied research experience, ask yourself:
- Was my applied research practice and process rigorous and ethical,
- Did it fit with my TAFE's Code of Conduct and national ethical standards,
- Did it tell the research story properly and fairly,
- Do I feel comfortable with the decisions I made, and
- How can I improve applied research practice?

FURTHER READING

> The National Health and Medical Research Council principles for peer review www.nhmrc.gov.au/about-us/publications/principles-peer-review

> Francesca Beddie and Linda Simon's (2017) VET Applied Research Developmental Framework, and accompanying document

4.2 REPORTING & APPLYING RESULTS



After feedback from peers and industry clients has been incorporated into your draft report, paper, presentation or performance, a final check is done before the research is shared with a broader audience.

In the case of reports, papers and presentations, this includes carefully editing the documents for grammar, vocabulary, spelling and punctuation and completeness (i.e. have I included all of the references and sources cited?).

PRESENTING APPLIED RESEARCH

A conference is a good way to start presenting applied research, either at an internal conference at your institute or an external conference relevant to your industry discipline or TAFE or broader tertiary education sector.

The annual Australian Vocational and Education Training Research Association (AVETRA) and National Centre for Vocational Education and Training Research (NCVER) conferences provide excellent opportunities for applied researchers in TAFE to present their applied research.

They also provide guidelines for writing and presenting conference papers and extensive databases of VET research on their websites (see Attachment 12).

PUBLISHING APPLIED RESEARCH

You can also choose to publish your research as a paper, journal article, book or book chapter. Your final report can be included in the VOCED Plus database. Getting published is a time-consuming process that requires considerable experience to achieve but it is worth aspiring to.

Ask your library or the State Library of Victoria to assist you to locate suitable publications such as Academic journals. These are publications that periodically publish scholarly papers in a specific field or discipline.

You can publish:

- Short papers intended to communicate research without too much detail,
- Review papers that summarize recent developments on a topic without new data, or
- Full articles that contain full details of your applied research project.

Papers submitted for publication must meet the guidelines provided by the publisher and are usually peer-reviewed or refereed before publication.

While there are thousands of academic journals to choose from, you can only submit a paper to one publisher at a time. Accompany your paper with a cover letter to the editor highlighting the importance of your research.

In the meantime, you can publish your report or paper on your institute's research database or as a conference paper. One good source of publication for Australian VET research work is the International Journal of Training Research.

TIPS FROM THE EXPERTS

- Do not get too discouraged if your paper is rejected by a publisher. Read editorial comments carefully and review your work accordingly.

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ATTACHMENTS

ATTACHMENT 1: BOYER'S FRAMEWORK OF SCHOLARSHIP

Boyer's (1990) framework of scholarships is made up of the scholarships of discovery, integration, application and teaching (Figure 7).

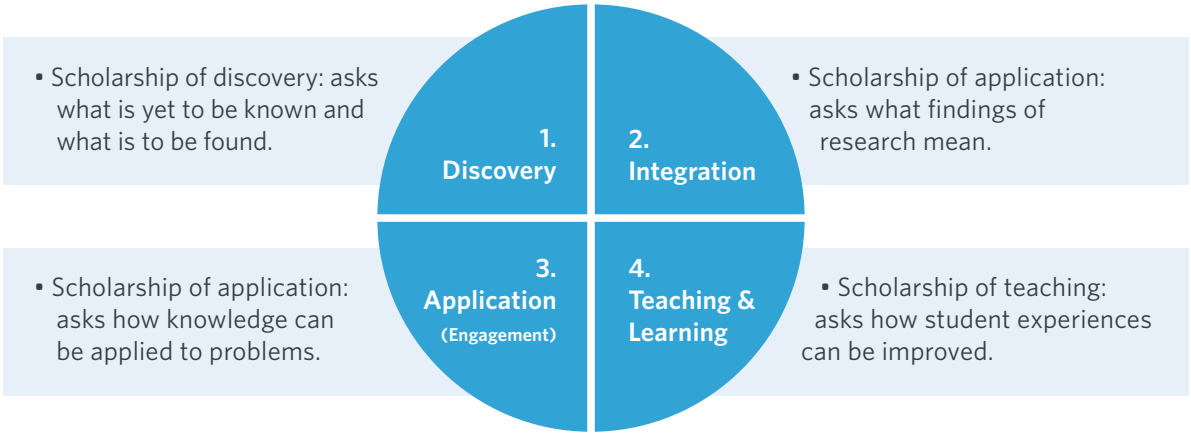

Figure7: Boyer's Framework of Scholarship (adapted from Boyer, 1990)

> The scholarship of discovery, like pure or basic research, is original work that advances human knowledge.

> The scholarship of integration connects and synthesises knowledge across disciplines (or topics within a discipline) to find out what the findings of research mean.

> The scholarship of application, like applied research, aims to find ways to apply theory in practice and solve problems in the service of the community,

> The scholarship of teaching investigates how new knowledge can deepen professional teaching knowledge and advance the quality of teaching and learning practices (Boyer, 1990).

One or more of Boyer's scholarships can apply to a research project.

FURTHER READING

> Ernest Boyer (1990): Scholarship Reconsidered. Priorities of the Professoriate

> Ernest Boyer (1996) The Scholarship of Engagement

> Scholarly engagement: Building knowledge in industry and the community in mixed-sector institutions

ATTACHMENT 2: STAGES IN THE APPLIED RESEARCH PROCESS

STAGE	OBJECTIVES AND ACTIVITIES
Getting started: Planning	
1. Defining the problem	Planning a research project starts with identifying and clarifying a question, problem or idea for research, developing a research question, setting goals and objectives for a research project and choosing an appropriate plan to collect and analyse data (methodology). A research proposal can guide the planning process and is developed in consultation with stakeholders such as industry or community partners, students, colleagues from TAFE or other institutions and government funding bodies. Once complete, the research proposal is ready for approval by a TAFE institute and industry, community or government clients (if involved). Ethics approval may be required if people and/or animals are involved in your applied research design.
2. Designing a research plan	
3. Obtaining approval	
Implementing applied research	
4. Collecting evidence	These steps involve identifying; collecting, analysing and interpreting the data collected using selected research methods and techniques. They can be a simultaneous activity to make sure there is sufficient quality data to answer the research questions. Once draft findings are determined, tested and evaluated, they can be recorded in a draft report, presentation, product, service or creative work.
5. Analysing data	
6. Testing & recording findings	
Sharing results	
7. Reviewing quality	The quality criteria involves obtaining feedback from peers and/or industry clients on the draft findings of the research, their relevance to the research question and the reliability and integrity of the research process. An important part of applied research is reflective practice by the researcher/s before a research project is finalised and findings are shared with a client and/or broader industry, community or academic audiences. Finally, depending on the nature of the research, the results are applied in industry, community or TAFE settings, the research cycle starts again as new questions, ideas, problems, and challenges spark further inquiry.
8. Reporting & applying results	

ATTACHMENT 3: DIFFERENT TYPES OF R&D

The examples of the application of different types of R&D below have been adapted from the Frascati Manual 2015.

BASIC RESEARCH	APPLIED RESEARCH	EXPERIMENTAL DEVELOPMENT
R&D in manufacturing industries		
An investigation into the properties of carbon fibres and how they can change according to their relative position and orientation within a structure.	The development of a method for processing carbon fibres at an industrial level with a degree of precision at the nano-scale.	The testing of how new composite materials using carbon fibre might be used for different purposes.
R&D in agricultural industries		
An investigation of genome changes and mutagenic factors in plants in order to understand natural controls for disease or pest resistance.	An investigation of wild potato genomes to locate the genes responsible for resistance to potato blight and improve resistance to disease.	The creation of a tool for genome editing by using knowledge of how enzymes edit DNA.
R&D in information and community technology		
An investigation of alternative methods of computation such as quantum computation and quantum information theory.	An investigation of information processing applications in new ways (e.g. new programming language or operating systems).	The development of new application software and substantial improvement of operating systems and application programmes.

ATTACHMENT 4: RESEARCH ETHICS

Human Ethics

The National Statement on Ethical Conduct in Human Research (2018) states that researchers are responsible for:

1. Ensuring that respect for participants is not compromised by the aims of research, by the way it is carried out, or by the results,
2. Fully informing participants of the purpose, methods and intended uses of the research, what their participation involves and what risks, if any, they may face,
3. Making sure the process of recruiting participants is fair, that there is no unfair burden on particular individuals and groups participating in the research, and that the benefits and outcomes of participation are distributed fairly and in a timely manner,
4. Taking reasonable steps to ensure the confidentiality of information supplied by human participants and their anonymity (when requested);
5. Informing participants that their participation is voluntary and making sure it is free from coercion. People who elect not to participate in research do not need to give any reason for their decision and are entitled to withdraw at any stage without suffering disadvantage, and
6. Declaring any conflicts of interest or impartiality to ensure the independence of the research (National Health and Medical Research Council, 2018).

Ethics for animal participation in research

The National Health and Medical Research Council also provides an Australian code for the care and use of animals for scientific purposes 2013 to ensure the ethical, humane and responsible care and use of animal participants (non-human vertebrates and cephalopods). The Code, adopted into legislation in all Australian states and territories, outlines guiding principles for each person involved in the care and use of animals for scientific purposes.

It is advisable for new applied researchers to familiarize themselves with your institute's Research Code of Conduct and/or policies and procedures before embarking on an applied research project.

ATTACHMENT 5: SAMPLE APPLIED RESEARCH PROJECT REQUEST FORM

Name of researcher	
Name of Client	
Name of Business	
Contact Details	
Research context	> Brief description of the business, industry and local environment
Project Summary	> What is the problem, idea or opportunity? > How long has the problem existed? > Have there been attempts to deal with problem? > Why is it important to solve the problem? > What are the objectives of the research? > What are the desired outcomes?
Project Scope	> What are the timeframes for the research? > What are the geographical boundaries of the project (local, regional, country)? > Where will the fieldwork take place? > Who will participate in the research? > How will the client be involved? > Who will oversee the project in the client's business?
Funding sources	> Who will fund the research? > How much financial support is available?
Further information	> Is there information available relating to the problem (past or current projects or research) and can you have access to it? > Is the information confidential? > What other information sources does the client recommend? > Who will own the intellectual property generated by the research? > What business constraints might affect the project? > What is the client's preferred communication mode?

ATTACHMENT 6: SAMPLE APPLIED RESEARCH PROPOSAL CHECKLIST

CONTENTS	DETAILS	CHECKLIST
Title	• Working title	> Does the title capture the essence of the research?
Brief summary	• From Project Request Form	> See Attachment 4
Background and rationale (up to 800 words)	• Research question • Rational and background for the research • Environmental review	> What is the problem? > What is the setting for applied research? > What are the key facts, debates and developments in the field? > What areas need further research? > What is the rationale for the research? What will it contribute to the field?
Methodology (up to 400 words)	• Research methodology • Research methods • Deliverables • Limitations of the research	> What conceptual/theoretical framework will you use? > What is your research design? > What are the sources of data, sample unit and size? > What research methods and instruments will you use? > What data processing and analytical techniques will you use? > What do you anticipate could limit your research (e.g. assumptions, conflicts of interest, access to data, budget and time)? > How will you ensure the validity and reliability of your findings?
Research Approval	• Governance • Names of applied researcher/s • Students (if involved) • Roles and responsibilities	> Who will have oversight of the research? > Who will be involved in the research? > Are there ethical issues and how will you deal with them? > Will the research need ethics approval?
Project Plan	• Stages of the project • Timelines • Budget	> What are the proposed timelines for the research? > Will you need a contractual agreement with an industry client? > What resources are required? > What are the risks to the applied research project and how will you mitigate them? > What is the budget? > Where is funding coming from? > How will you ensure effective communication with a client?
Reporting		> How will you report your findings and how often? (i.e. will you report interim results)?
Referencing		> How will you reference and cite sources of information that are not original to you?

ATTACHMENT 7: A SHORT GUIDE TO WRITING AN ENVIRONMENTAL (LITERATURE) REVIEW

An environmental (or literature review) is usually written in standard essay format, which includes an introduction, a body of text, a conclusion and bibliography (or list of references). When complete, it should not be a summary of what you have read but a critical discussion demonstrating you know and understand what others are saying about the problem or idea under investigation and have used this knowledge to inform your research design.

To start writing a review:

- Read each information source relevant to your study and summarise what you find in a paragraph, trying to trace the logic of the arguments and assumptions underpinning what you read.
- Use a standard format to record each source such as; what the study is about, what is the history, what was the methodology, what are the main findings and conclusions and what are its strengths and limitations. List the source of the information in a references page to credit authors.
- Carefully copy direct quotations that you think you might use.
- Allocate credit to authors in the body of the text (citation) using correct referencing and citations to avoid the potential of plagiarism and infringement of copyright law. This will also allow readers of your applied research to find sources if they wish to. (Details of how to reference and cite sources are in Attachment 8).
- Look for a theoretical position that others have taken for their research.
- Compare different approaches, conclusions and solutions to the problem, keeping an eye out for patterns, trends and repetitions.
- Order your summary paragraphs into sections according to the research questions or topics and relevance of the information to your research problem.
- Write a conclusion that summarises the main findings in the existing research, highlighting gaps and unanswered questions.
- Finish by writing an introduction that clearly describes the topic, why the research is important and mentions the landmark research in your field. Conclude your introduction with a clear purpose and rationale for your research.

Start writing early, summarising key concepts, theories, arguments, controversies, useful diagrams and graphs from each text and accurately record the source of information. Follow up sources of interest cited in the text of papers and reports for additional information.

You will be collecting a lot of information so try to organise what you read into general themes as you read and highlight agreements and disagreements between authors and views that might support or contradict your thinking about the problem.

ENVIRONMENTAL /LITERATURE REVIEW CHECKLIST:	
> Have you provided an introduction to the literature and explained how it relates to your problem?	☐
> Have you articulated the key ideas and concepts in the literature related to the problem?	☐
> Have you explained the theoretical background behind the literature?	☐
> Have you provided a critical account of developments and issues in the field related to your research problem?	☐
> Have you identified areas/questions for further research?	☐
> Have you summarised the main findings in the existing research, highlighting gaps and unanswered questions in a concise conclusion?	☐
> Have you accurately recorded and cited your sources in the text and bibliography?	☐

FURTHER RESOURCES

> The University of Queensland guide to writing a literature review www.uq.edu.au/student-services/pdf/learning/lit-reviews-for-rx-students-v7.pdf

> The University of Melbourne's library guide to referencing, citations and acknowledgements www.library.unimelb.edu.au/recite

> Monash University guide to finding and reviewing literature www.guides.lib.monash.edu/gradres/finding-literature

> VU Vocational Education and Training (VET) Infolink www.w2.vu.edu.au/library/infolink/education/vet1.htm

> ERIC (education literature, international) www.eric.ed.gov/

> VOCED (VET research, Australian & international) www.voced.edu.au/

ATTACHMENT 8: HOW TO REFERENCE AND CITE DATA SOURCES

Conventions for references and citations differ between disciplines. The convention used in this Guide and in following examples follows the APA sourced from the University of Melbourne's library www.library.unimelb.edu.au/recite. The order of references under the APA style is:

JOURNAL ARTICLE	AUTHOR/S	YEAR OF PUBLICATION	TITLE OF ARTICLE	NAME OF PUBLICATION	VOLUME	ISSUE	PAGE NO.
Example	Boyer. E.	(1996)	The scholarship of engagement	Journal of Public Service and Outreach	1	(1)	pp. 11-20
BOOK	**AUTHOR/S**	**YEAR OF PUBLICATION**	**TITLE OF BOOK**	**PUBLISHER**	**PLACE OF PUBLICATION**		
Example	Denzin, N.K. & Lincoln, Y.S.	(2005)	The Sage Handbook of Qualitative Research	Sage Publications	London, UK		

In text, you would cite Boyer in a sentence as:

- Boyer (1996) argues . . . . or,
- In his major study, Boyer (1990, page X) discusses. . . .or,
- When directly quoting Boyer, 'As a scholarly enterprise, teaching begins with what the teachers know' (Boyer, 1996, page 23).

When there is more than one author, they are referenced in the order in which they appear in the text.

When there are more than three authors, you cite the first author's name only in text and replace the rest with et al. For example, the reference: Gray, C., Turner, R., Sutton, c., Petersen, S. Stevens, J. Swain, B. Esmond, C. Schofield & D. Thackeray (2015). Research methods teaching in vocational environments: developing critical engagement with knowledge? Journal of Vocational Education & Training, 67:3, 274-293, would be referenced in the bibliography in full but cited in text as (Gray et al., 2015) or Gray et al (2015) found . . . .

Most academic papers and texts will provide the correct citation to use in the first few pages. You can use whichever style of referencing and citation you chose as long as it is consistent through your report. Details of correct citations and other types of referencing, citation and acknowledgements can be found at the University of Melbourne library website www.library.unimelb.edu.au/recite. Referencing software such as Endnote can be invaluable for recording sources and referencing them in your proposal and final research report or paper.

ATTACHMENT 9: REFINING A RESEARCH QUESTION

Two hypothetical examples of how to refine a research question are provided below.

1. Take the research question: 'How can outcomes for disadvantaged learners in VET be improved?' At this point, this question is very vague and ambiguous. For example,

> What sorts of outcomes are to be investigated (are they employment outcomes, personal satisfaction outcomes or literacy and numeracy outcomes for example)?

> Who are the learners and what type of disadvantage is being referred to (at this point the question refers to all disadvantaged learners in VET with no demographic or geographic boundaries)?

> What sort of VET programs are the learners studying?

> What sort of VET provider are they studying with?

Studying all disadvantaged VET learners in all VET providers would be a very large research project. The research question might be further refined using answers to these queries. A better framing of the research question might be:

'How can literacy and numeracy outcomes for disengaged young male VCAL students be improved in TAFE?' However, studying all male VCAL students in TAFE is still a big undertaking. The question could be further refined to,

'How can literacy and numeracy outcomes be improved for disengaged young male students aged 16-18 years studying VCAL programs in TAFE in East Gippsland?'

You could add sub-questions for this project such as: What factors lead to improved literacy and numeracy outcomes for disengaged young male VCAL students aged 16-18 years in TAFE in East Gippsland?

For a second example, take a possible research question posed by an industry partner in the construction industry such as that in Table 2 (page 23), 'How can major constraints to large construction projects be effectively managed? At this point, this broad question contains a number of ambiguities:

> What constraints are being referred to,

> What sort of construction is involved,

> What location/s does the question refer to, and

> What is the abstract claim about the problem (that is what the impact of not managing the constraints is)?

A research project based on this question would be almost impossible to investigate. A much better framing of the research question might be: 'How can major constraints to the management of large construction projects in the domestic housing industry be effectively managed to improve productivity?'

The question however is still broad both in geographic location and type of productivity and can be further refined to,

'How can major constraints to large in the domestic housing construction projects in Melbourne CBD be more effectively managed to improve labour productivity?'

ATTACHMENT 10: EXAMPLES OF RESEARCH DESIGNS

Research designs can be classified into two types; experimental or non-experimental.

EXPERIMENTAL	A research design used to discover new relationships between variables in phenomena. Experimental research usually requires a hypothesis (prediction) and the testing by isolating and controlling different conditions and observing cause and effect on the subject of the study. It is well suited to answering why, what if and how questions (Baimyrzaeva, 2018).
CASE STUDY	A common research design that is used to investigate specific 'cases' that represent (or significantly atypical of) a complex problem, episode, event or phenomena occurring in a population in its living context. Case study design aims to gain in-depth insight into how people and things interact in the context and is useful for exploring a topic that little is known about.
ETHNOLOGICAL	A qualitative research design used to study people as they work and live in a specific social, cultural and economic environment. Ethnological research is interested in how people interpret and understand their experiences and behaviours in their environment.
DESCRIPTIVE	A qualitative research design that investigates a situation, problem or phenomenon in a demographic population without in-depth analysis of why the phenomenon is occurring through observations.
PHENOMENOLOGICAL	An approach to qualitative research that investigates sets out to describe a situation, problem or phenomenon to obtain an in-depth understanding of what and why it is happening.
ACTION	Focuses on studying a specific problem in a particular context in the real world as changes are made to improve it. The researcher is usually a participant in the research and a member of the community under study. Data is obtained from observations of behaviour.
NARRATIVE	A qualitative research design that investigates the biographical history of a group of people in relation to a phenomenon, or problem by focusing on written and spoken words or visual representations as told through the stories told by individuals.
EVALUATION	A common research design in TAFE used to investigate and assess the value of programs, systems, processes, contexts, products and services to stakeholders. Evaluation models include system analysis to analyse the interdependencies of components of a system, and program evaluation (sub - classified into four types: context, input, process and product evaluation).
CRITICAL INQUIRY	A research design that looks to study whose interests are served by the practices, policies or phenomenon under study. It focuses on how contextual factors impact on the health, safety and wellbeing of people.
CULTURAL	A research design concerned with interpreting language and culture to analyse how people communicate with each other in a social context and phenomenon using cultural texts and media.

ATTACHMENT 11: QUALITATIVE STANDARDS FOR SCHOLARLY PERFORMANCE

Glassick, Huber and Maeroff (1997) extended Boyer's work by developing six standards to measure the quality of scholarship.

STANDARD	QUESTIONS
1. Clear goals and well-defined purpose	Does the scholar: > State the basic purposes of his or her work clearly? > Define objectives that are realistic and achievable? > Identify important questions in the field?
2. Adequate preparation	> Show an understanding of existing scholarship in the field? > Bring together the skills to their work? > Bring together the resources necessary to move the project forward?
3. Appropriate methods	> Use methods appropriate to the goals? > Apply effectively the methods selected? > Modify procedures in response to changing circumstances? > Maintain records of process and outcomes?
4. Significant results	> Achieve the results? > Add consequentially to the field? > Open additional areas for further exploration?
5. Effective communication	> Use a suitable style and effective organisation to present their work? > Use appropriate forums for communicating the work to its intended audiences? > Present their work with clarity and integrity?
6. Reflective critique	> Critically evaluated his or her own work? > Bring an appropriate breadth of evidence to their critique? > Use evaluation to improve the quality of future work?

ATTACHMENT 12: ADDITIONAL RESOURCES

> **Australian Association for Research in Education (AARE)**
AARE is a national professional association of educational researchers in Australia, which provides support for researchers from Australian universities; local, state and federal governments; early childhood education contexts; schools, colleges and training organisations; as well as private research agencies and produces the Australian Educational Researcher (AER) journal. www.aare.edu.au/

> **Australian College of Educators (ACE)**
ACE is also a national professional association for the education profession across all levels, sectors, systems and subjects and publishes the Professional Educator.

> **Australian Vocational Education and training research Association (AVETRA)**
AVETRA provides a wealth of resources for VET researchers on the website www.avetra.org.au/pages/resources-the-research-process-71.html The AVETRA Hub is an online platform for VET researchers involved in research. It is particularly aimed at VET teachers and other practitioners who are interested in practice-based research. www.avetraeducatorhub.org/ The International Journal of Training Research, which is peer-reviewed and published three times a year by Taylor & Francis Group on behalf of AVETRA.

> **Edna (Australia's free online network for educators)**

> **Google Scholar**
You can use Google Scholar to search: peer-reviewed papers, theses, books, abstracts and articles, from academic publishers, professional societies, digital repositories, universities and other scholarly organizations across many disciplines.

> **NCVER**
The National Centre for Vocational Education Research (NCVER) is a national body that collects and analyses and stores information on Australia's VET sector. It also undertakes a program of educational research, including national VET statistics and survey data and the Longitudinal Surveys of Australian Youth (LSAY). You can access a wide range of research papers on VET at www.ncver.edu.au/ For a while the National Centre for Vocational Education Research (NCVER) funded a Community of Practice to foster the development of research skills for VET staff and publish the results to the sector which can be accessed at: www.voced.edu.au/search/site/sm_metadata.collection%3ACommunitiesOfPractice?solrsort=ss_dateNormalized%20desc

> **NZResearch**
NZResearch is a comprehensive selection of research papers and related resources that includes peer-reviewed and other research from universities, polytechnics, and research organisations throughout New Zealand. www.nzresearch.org.nz/

> **VOCED Database**
VOCEDplus is a free international research database for tertiary education managed by NCVER where you can find previous research papers on VET and HE, adult and community education, informal learning, and VET in Schools policy, practice and published statistics. It is produced by NCVER, funded by Australian Commonwealth, State and Territory Governments and endorsed by the UNESCO-UNEVOC International Centre in Bonn, Germany. www.voced.edu.au/

Look for project reports from the NCVER Community of Practice of applied research at www.voced.edu.au/search/site/sm_metadata.collection%3ACommunitiesOfPractice?solrsort=ss_dateNormalized%20desc

> **Victorian State Library**
Victoria's State Library has an extensive collection of books and journals that are free to access over a wide range of subjects. You can access free tutorials on how to search the catalogue (go to the events tab on the home page) and you cannot borrow resources. You can however, access a range of e-journals and books from home (by joining free) and work in the library anytime. www.slv.vic.gov.au/

> **Victorian TAFE Association (VTA)**
The VTA provides quick links to Victorian, national and international resources on the Research Gateway. The Victorian Practitioner Research Network (VPRN) on the VTA website encourages VET practitioners to engage in applied research and join a community of practice. www.vprn.edu.au/ The VPRN provides quick links to a number of other resource repositories in Australia and overseas.

> **VET Development Centre**
The VDC website provides opportunities for professional development and access to research in VET. It also produces a newsletter, VDC News, which may be useful to you.

GLOSSARY OF TERMS

TERM	DEFINITION
Applied Research	Original investigation undertaken in order to acquire new knowledge that is directed primarily towards a specific, practical aim or objective (OECD, 2015: 45).
Basic Research	Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any application or use in view (ibid.)
Bias	Deliberate or unconscious distortion of an analysis process due to human influences such as personal beliefs and prejudices and other influences such as financial incentives.
Citation	Acknowledgement of a source of information or a quotation provided in the text of a report or presentation. The source is cited in an abbreviated form with full details provided in the list of references.
Coding	Applying labels or tags to categories of collected data in order to organise it into manageable checks and prepare it for analysis.
Epistemology	The theory of knowledge and how we use knowledge to make sense of the world.
Ethics	Rules and principles that govern the conduct of research and the protection of people when they are participants in research projects.
Experimental Development	Systematic work that draws on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes (Ibid.).
Focus Groups	A qualitative research method that collects evidence from a group of people selected for their expertise or involvement in a phenomena that discuss a research subject or question.
Innovation	Innovation is the implementation of a new or significantly improved product (good or service), or process, new marketing method, or a new organisational method in business practices, workplace organisation or external relations (OECD, 2005: 46). Innovation is also defined as absorbing knowledge, applying it to new uses and creating new knowledge in order to bring an idea to a desired outcome (Schuetze, 1999).
Intellectual property	Intellectual property (IP) represents creations of the mind or intellect that can be legally owned and protected by IP laws. IP can include patents, trademarks, designs, process and formulae, inventions or application of an idea. Foreground IP is created during the applied research process. Background IP is pre-existing information provided by either party that is used during the project.
Methodology	The systematic strategy used to guide an investigation into a problem, phenomena, gap in knowledge or opportunity in a field of study. Typically it includes a theoretical model, research design and mode of enquiry (quantitative or qualitative techniques).
OECD	Organisation for Economic Cooperation and Development
Plagiarism	Using other people's thoughts, writing, diagrams, graphs etc. without acknowledging them either in text, bibliography or presentations.
Primary data	Original information that a researcher collects directly from a source that is not obtained by another researcher such as data form interviews, observations, experiments etc.

TERM	DEFINITION
Population	The total quantity of possible samples that are the subject of a research project.
Positivism	An epistemological view that maintains that all phenomena to be studied can be analysed using rational scientific methods. There is a universal truth and reality that can be measured and discovered.
Qualitative Research	Measures the quantity or amount of phenomena and uses logical or statistical observations to draw conclusions.
Quantitative Research	Investigates phenomena relating to human behaviour and is interested in the views and experiences of people either observing or experiencing a problem
Reflective Critique	Is deliberate, purposeful and meaningful thinking about one's professional practice in a critical way to deepen knowledge and understanding and improve practice.
Reliability	Refers to researchers having sufficient evidence to ensure that research findings are accurate and not subject to any biases they may have.
Research problem	A general abstract statement of an idea, issue or problem that merits research and forms the basis of research questions, hypotheses, goals and objectives and methodological design.
Sampling	The process of selecting a small part of a whole (population) that will represent what the whole is like in relation to a research question.
Secondary data	Data collected from others such as from academic papers, reports, administrative records and archival data.
Theory	A theory is formulated to explain, predict and understand phenomena.
Validity	Refers to the credibility, accuracy and objectivity of the research findings and that the study achieved what it said it would do.
Methodology	The systematic strategy used to guide an investigation into a problem, phenomena, gap in knowledge or opportunity in a field of study. Typically it includes a theoretical model, research design and mode of enquiry (quantitative or qualitative techniques).

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AN INTRODUCTORY GUIDE

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