Australian Government

Office for Learning & Teaching

Ag LTAS

Learning and Teaching Academic Standards Statement for Agriculture

About

The Learning and Teaching Academic Standards Statement for Agriculture is a project deliverable from: A consensus approach to defining standards for learning outcomes and informing curricula design for agriculture.

Support for this project has been provided by the Australian Government Office for Learning and Teaching. The views expressed in this document do not necessarily reflect the views of the Australian Government Office for Learning and Teaching.

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University of Tasmania

The University of Adelaide

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Executive summary

Higher education providers aim to design and deliver programs that meet agreed standards, attract high numbers of students and produce skilled graduates.

The national Learning and Teaching Academic Standards Statement for Agriculture (AgLTAS Statement), presented here, has been developed through an extensive consultation process between academics, students and industry across Australia. It will facilitate the implementation of academic standards by the agriculture discipline community, inform curriculum design and assist in identifying marketing opportunities for degrees.

The Statement includes five key Threshold Learning Outcomes (TLOs) for bachelor degrees in agriculture:

- Knowledge
- Understanding
- Inquiry and Problem Solving
- Communication
- Personal and Professional Responsibility

The TLOs describe what a pass-level graduate in agriculture or a related discipline will know, understand and be able to do upon graduation.

Higher education providers are encouraged to build on these TLOs as they design and deliver programs that reflect their particular strengths and priorities. They may do this by adding additional TLOs, or by requiring the five TLOs to be met at a higher standard in their own organisation.

If implemented as a reference point, the AgLTAS Statement will support each provider's autonomy, diversity and reputation, while enabling future students and industry to have confidence that their degree meets minimum standards.

Building on knowledge

The AgLTAS Statement closely references the Learning and Teaching Academic Standards defined for the science discipline[1].

In 2012, a pilot project undertaken by the University of Tasmania in collaboration with Charles Sturt University and The University of Adelaide demonstrated that the TLOs for science could be adapted successfully to the study of agricultural science.

The University of Tasmania, in collaboration with partners from Charles Sturt University, The University of Adelaide and University of Western Sydney, subsequently secured funding from the Australian Government's Office for Learning and Teaching (2013–2015) to develop a National Academic Standards Statement for Agriculture.

[1] *Jones S, Yates B, & Kelder J. (2011). Learning and Teaching Academic Standards Statement for Science. Sydney, Australia: Australian Learning and Teaching Council.*

Project outcomes

1. A holistic appreciation amongst academics and industry of the agriculture curriculum taught at universities. This provides opportunities to improve: linkages between units/courses; learning pathways through the degree levels; and provision of graduate training by industry.
2. A network of practice between universities and industry through shared engagement in the development of the AgLTAS Statement.
3. An established strong foundation providing students with confidence that their degree meets minimum standards, while allowing each university the freedom to clearly promote the unique aspects of their degree offering as delivered.
4. A nationally agreed AgLTAS Statement (including the nature and extent of agriculture and agriculture TLOs). National consensus was achieved through consultation with academics, students and industry stakeholders.

Future steps

The TLOs for agriculture will be trialled to benchmark the academic standards achieved in four universities teaching agriculture and related disciplines. An online curriculum-mapping tool has been developed for this purpose, which produces a report allowing users to see where minimum TLOs are reached or are not achieved.

The results of curriculum mapping will be distributed as case studies that will form the basis for the development of future Good Practice Guides.

Endorsement

The Australian Council of Deans of Agriculture (ACDA) commends the project team on the consultative process used to develop the Learning and Teaching Academic Standards Statement for Agriculture. The Council endorses these standards as a high-level statement of bachelor-level Threshold Learning Outcomes for the discipline.

Acknowledgements

We acknowledge the support and engagement of all academics, industry representatives and students who participated in the AgLTAS project.

How to use this resource

The core of the AgLTAS Statement (page 6 - 7) is essential reading. Notes on the TLOs (page 9 - 13) provide details that better define what the TLOs are designed to achieve. Sections from page 16 onwards are more detailed descriptions of the consultation and development process.


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each provider’s autonomy,
diversity and reputation, while
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Project background

In 2011, the Australian government introduced the Tertiary Education Quality and Standards Agency (TEQSA) Act. It mandated that the delivery of courses by higher education institutions for Australian higher education awards be regulated using a standards-based quality framework. Learning outcome statements have been proposed by the national Higher Education Standards Panel as an example of a reference point that higher education providers may choose to use to demonstrate compliance with the Higher Education Standards Framework in relation to learning outcomes and assessment.

Several discipline groups in the tertiary sector have published Learning and Teaching Academic Standards (LTAS) Statements, which describe what pass-level graduates of each discipline will know, understand and be able to do upon graduation. These Statements were developed through wide consultation with the higher education sector and associated industry, and are now being implemented through the design and quality assurance of curricula.

Value of and need for the project

Agriculture and related disciplines are offered in 14 Australian universities (as a three- or four-year specialist degree or as a major in a science degree).

The Australian Council of Deans of Agriculture (ACDA) and others have identified a skills shortage in agriculture and related disciplines. Annually, there are almost 5,000 jobs available for approximately 800 graduates nationally. Federal and state government inquiries into higher education and skills training for agriculture and agribusiness have highlighted the importance of ongoing tertiary education in agriculture, both for Australia's economic prosperity and to enable national objectives for food production and supply to be met.

Critical issues affecting the ability of universities to meet the skills shortage in agriculture are the design, content and delivery of the agriculture curriculum and the promotion of agriculture as a career to new students. The development of a specific LTAS Statement for agriculture (AgLTAS) aims to address these issues through informing curriculum design.

Involving both industry and students during the consultation process ensured the relevance of the AgLTAS Statement for agriculture graduates. More generally, publication and implementation of the AgLTAS Statement will advance the development and interpretation of Threshold Learning Outcomes (TLOs) for other science disciplines.

Scope

For the purpose of this Statement, 'agriculture' encompasses a range of degrees and sub-disciplines, including (but not limited to):

- Agribusiness
- Agricultural economics
- Agriculture and agricultural science
- Agricultural business management
- Agrifood systems
- Animal science
- Horticulture
- Viticulture and oenology
- Wine business
- Wine science

Rationale

The AgLTAS project extends the successful work of a pilot project at the University of Tasmania in 2012 that demonstrated that the nationally agreed TLOs for science could be adapted successfully to the study of agricultural science[2]. That project used a process of peer-to-peer professional learning between academics in the School of Agricultural Science to develop draft TLOs for agricultural science and briefing notes on the nature and extent of the discipline. The project team then sought qualitative feedback from a survey of academics at the University of Tasmania, and from course coordinators at Charles Sturt University and The University of Adelaide.

The draft TLOs for agricultural science were presented to the ACDA in November 2012. There was consensus on a need for nationally agreed TLOs that would enable the broader discipline of agriculture to demonstrate compliance with TEQSA requirements for regulation and quality assurance of tertiary education against agreed learning standards.

Consultation and development

The project broadly followed the approach developed by the national Learning and Teaching Academic Standards project[3], but with adaptations developed during the pilot project. Specifically, the AgLTAS project consisted of two parallel, interacting streams of activity:

Activity stream 1: Consultation

The consultation activity stream used an engagement strategy outlined by Hinton, Gannaway, Berry and Moore (2011)[4] and included:

1) Assessing the readiness for change (initiated in the pilot project).
2) Engagement with a range of stakeholders throughout the project.
3) Transfer of project outcomes.

Consultation data were collected using a mix of quantitative and qualitative methods, including an online survey and face-to-face workshops.

Activity stream 2: Drafting the AgLTAS Statement

Embedding Bloom's taxonomy[5] in the drafting activity stream provided a structure for collecting and analysing participant responses as data, and provided a transparent process that enabled the project team to explain and justify decisions on the TLOs included in the final version of the AgLTAS Statement.

Further details of the consultation and development process are provided on page 16, and are described in detail in Botwright Acuña et al. (2014)[6]

[2] *Botwright Acuña TL, Kelder J, Lane P, Hannan G, & Jones S. (2013). Developing Threshold Learning Outcomes for Agricultural Science. International Journal of Innovation in Science and Mathematics Education 21: 43–55.*

[3] *Australian Learning and Teaching Council. (2011). Resources to Assist Discipline Communities to Define Threshold Learning Outcomes (TLOs). Sydney, Australia: Australian Learning and Teaching Council.*

[4] *Hinton TD, Gannaway D, Berry B & Moore K. (2011). The D-Cubed Guide: Planning for Effective Dissemination. Sydney, Australia: Australian Learning and Teaching Council.*

[5] *Bloom BH, Englehart MD, Furst EJ, Hill WH & Krathwohl DR. (1956). Taxonomy of Educational Objectives: Handbook 1. Cognitive Domain. New York: David McKay Company Inc.*

[6] *Botwright Acuña TL, Kelder J, Able AJ, Guisard Y, Bellotti, McDonald G, Doyle R, Wormell P, & Meinke H. (2014). Academic, Industry and Student Perspectives on the Inclusion of "Vocational Knowledge" in a 'Learning and Teaching Academic Standards Statement' for Agriculture. Journal of Learning Design 7: 1–15.*

Learning and Teaching Academic Standards Statement for Agriculture

Nature and extent of agriculture

Agriculture is defined as the land-based production of food, fibre and fuel as quality products that may be used unchanged or be transformed into other products for the good of society. Agriculture applies technologies and knowledge gained from multiple disciplines to manage agro-ecosystems in a way that produces more from our natural resources than could be achieved without intervention. Agriculture adopts a stewardship role to foster environmental, economic and social sustainability.

Agriculture is undertaken in diverse and variable systems that span the entire value chain from production to consumption. Agriculture has its foundation in scientific method. Evidence gained from empirical investigations is applied in the development of new technology, processes and practices in the value chain to improve productivity. The process of extension, diffusion and adoption of new agricultural practices at local, national and global scales depends on effective communication and is underpinned by the application of rural sociology and education.

Degrees in agriculture provide a wide range of knowledge and skills across broad subject areas, allowing career flexibility for graduates. Graduates of agriculture and related sub-disciplines are employed in diverse roles that contribute to the successful practice of agriculture to meet the needs of society.

Such roles include (but are not limited to):

- Research and the generation of new knowledge and technologies
- The development and application of knowledge and technologies to solve complex problems and create opportunities
- Primary production in the value chain
- Educators in secondary and tertiary institutions
- Extension and adoption of knowledge by society
- Provision of policy and regulatory advice
- Provision of advice by finance and marketing professionals
- Agriculture professionals who provide leadership and advocacy
- Media specialists who communicate about agriculture

Agricultural industries use a range of specialised disciplines to develop sustainable production systems. Graduates must therefore be life-long learners, capable of undertaking continued professional development that may include higher degrees or diplomas, or industry-sponsored certification to practice agriculture as professionals.

Threshold Learning Outcomes for agriculture

Upon completion of a bachelor-level degree in agriculture or a related sub-discipline, graduates will, as a minimum, be able to demonstrate their knowledge and skills in the following areas:

Understanding agriculture

1. Demonstrate an integrative understanding of agriculture by:
    - 1.1. Explaining the role and relevance of agriculture and its related sciences, and agribusiness in society.
    - 1.2. Understanding the major biophysical, economic, social and policy drivers that underpin agricultural practice and how they contribute to practice change.
    - 1.3. Understanding how information is adopted and the context within which producers, processors and consumers make decisions.

Knowledge of agriculture

2. Exhibit depth and breadth of knowledge of agriculture by:
    - 2.1. Demonstrating knowledge of the core sciences in the context of agriculture.
    - 2.2. Demonstrating broad generalist knowledge of relevant agricultural production systems and their value chains, with specialist knowledge in at least one area.
    - 2.3. Understanding how knowledge from different sub-disciplines within agriculture is integrated and applied into practice.
    - 2.4. Demonstrating a basic knowledge of economics, business and social science as they apply to agriculture.

Inquiry and problem solving

3. Critically analyse and address dynamic complex problems in agriculture by:
    - 3.1 Identifying contemporary issues and opportunities in agriculture.
    - 3.2 Gathering, critically evaluating and synthesising information from a range of relevant sources and disciplines.
    - 3.3 Selecting and applying appropriate and/or theoretical techniques or tools in order to conduct an investigation.
    - 3.4 Collecting, accurately recording, analysing, interpreting and reporting data.

Communication

4. Be effective communicators by:
    - 4.1 Understanding methods of effective two-way written and verbal communication with different audiences.
    - 4.2 Communicating with a range of audiences in an agricultural context using a variety of modes.

Personal and professional responsibility

5. Be accountable for their own learning and professional work by:
    - 5.1 Being independent and self-directed learners.
    - 5.2 Working effectively, responsibly and safely in an individual and team context.
    - 5.3 Demonstrating knowledge of the regulatory frameworks relevant to their specialist area in agriculture.
    - 5.4 Personally practising ethical conduct.


Agriculture is undertaken
in diverse and variable systems
that span the entire
value chain from production
to consumption.

Notes on the TLOs: understanding agriculture

These notes are intended to guide the interpretation of the TLOs. The notes and the TLOs should be considered in the context of the nature and extent of agriculture on page 6. Some of the explanatory notes draw, with permission, upon the Science LTAS[7].

Understanding agriculture

An integrative understanding: students are required to demonstrate that they possess a holistic understanding of the combined components of agriculture as defined in the statement on the nature and extent of the discipline.

TLO 1.1

The role and relevance of agriculture: this phrase encompasses the impact, significance, and relevance of agriculture to society, which is inclusive of the lifestyle, livelihoods and traditions of rural communities at local and global levels. These range from large-scale commercial company operations to subsistence family units. Graduates will be able to justify and make decisions based on the context of their understanding of agriculture.

Society: agriculture has a pivotal role in society through the provision of food, fibre and fuel. Society includes members of the value chain of producers, manufacturers and consumers, and members of communities: rural, urban, national and international.

TLO 1.2

Agricultural practice: graduates of agriculture will have a general understanding of the methods used in primary production of food, fibre or fuel consistent with the sustainable use of natural resources.

Practice change: the application of new technology and processes results in a change in the methods used in agricultural practice consistent with a total marketing approach. The drivers of change may be complex and graduates need to understand that these may include components of science, social science, business, economics and governance.

TLO 1.3

How information is adopted: graduates need to understand that adoption has a basis in practice change, communication and the process of learning in adults. Learning is undertaken through a well-defined cycle of planning, action, observation and the development of general management strategies that are applied in the context of agricultural practice.

Context within which producers, processors and consumers and other stakeholders make decisions: graduates will understand the relevance of patterns in consumer decision-making, the value proposition and how information is communicated between producers, processors and other stakeholders. Integral to this is understanding that changes in demand are created using planned strategies that may occur at different levels in the value chain.

[7] *Jones S, Yates B & Kelder J. (2011). Learning and Teaching Academic Standards Statement for Science. Sydney, Australia: Australian Learning and Teaching Council.*

Notes on the TLOs: knowledge of agriculture

Knowledge of agriculture

Depth and breadth: graduates will generally have an advanced knowledge of agriculture. In some courses graduates may specialise in one or more sub-disciplinary areas. Agriculture graduates will be able to understand how their disciplinary area relates to others, and integrate their knowledge across the sub-disciplinary areas in which they have studied.

TLO 2.1

Core sciences: graduates require knowledge of the science disciplines as they apply to agriculture. These may include biology, mathematics, chemistry and physics.

TLO 2.2

Broad generalist versus specialist knowledge: agriculture graduates will have specialised in their study and will have acquired a coherent body of knowledge in one or more sub-disciplinary areas. They will understand the structure of this knowledge and the way it is integrated, and have some command of the principles, concepts and core knowledge of the sub-disciplinary area.

Agricultural production systems: describes the different approaches that can be used in the production of food, fibre or fuel in a managed agro-ecosystem.

Value chains: are the activities that a firm operating in agriculture performs in order to manage, package, preserve or transform the raw products of agricultural production to deliver a product that is valued by the buyer/consumer.

TLO 2.3

Knowledge is integrated: graduates will recognise that knowledge of agriculture is combined across multiple disciplines including biological, environmental, economic and social sciences. 'Farming systems', which integrates the natural resource base, climate and agricultural enterprises, including primary production, household livelihoods and the value chain, provides examples particularly relevant to agriculture.

Disciplines: this term is used in this document to describe a sub-discipline of agriculture. It may include, but is not limited to: agronomy, agribusiness, agricultural economics, animal science, viticulture, horticulture, microbiology, plant pathology, soil science, biochemistry, plant and animal breeding, agronomy and animal physiology.

TLO 2.4

Knowledge of economics, business and social science: graduates will have a general knowledge of economics, business and social sciences and how these are applied to agriculture. This knowledge complements that of the core sciences and agricultural sub-disciplines.

Notes on the TLOs: inquiry and problem solving

Inquiry and problem solving

Dynamic complex problems: agricultural systems are complex due to interactions and interdependency between the component parts of agricultural systems that are themselves characterised by constant change and activity. Undergraduate students' knowledge and practical skills in agriculture are often reinforced through an essential or expected requirement to undertake work-integrated learning; for example, a period of work experience or placement.

TLO 3.1

Contemporary issues and opportunities: progress in addressing the dynamic complex problems of agriculture will require graduates to be able to identify current and future issues and opportunities in the discipline. Graduates need to recognise that information is constantly changing and be able to analyse and formulate ideas regarding a new problem or opportunity.

TLO 3.2

Gathering, critically evaluating and synthesising information: graduates will be able to find information from a range of sources. This term is used to indicate that reliable information can be gathered from academic, industry and other sources relevant to the issue. Graduates can determine the relevance of the information to the issue and can organise this information. They will also be able to check and make judgements about the reliability of information, and synthesise it to produce a coherent body of work.

TLO 3.3

Theoretical techniques or tools: graduates will have some practical skills and knowledge of the most appropriate techniques relevant to the agricultural sub-discipline and system of interest that will allow them to solve different types of problems, or that will create opportunities for advancement (not all of which emerge from problems). These may include laboratory and field-based techniques using tools such as instruments, apparatus, mathematical and statistical approaches, including modelling, or information and communication technologies.

Conduct an investigation: agriculture graduates will be able to form hypotheses in a logical manner and then design activities or experiments to test these hypotheses. Graduates are able to apply a sequence of data acquisition, data analysis, and drawing of conclusions that is recognised as a 'scientific method' relevant to the agricultural sub-discipline or system. This supports a systematic approach to problem solving that is underpinned by an understanding of the requirement for good organisational and time-management skills.

TLO 3.4

Collecting, accurately recording: it is important that agriculture graduates can accurately record data from experiments or other sources. They will understand that, while different scientists may interpret the data differently, the raw data themselves are inviolate.

Analysing: graduates can apply mathematics and statistical approaches to refine and interpret data. Where appropriate, they may apply qualitative analysis.

Interpreting and reporting: agriculture graduates will be able to check observed data and determine if such data meet or refute a hypothesis. They will be able to draw valid conclusions, and summarise their results clearly and accurately.

Notes on the TLOs: communication

Communication

Effective communicators: this term implies more than just presenting information. Agriculture graduates will engage with their audience and be able to convey their message in a clear and understandable manner. They will be able to engage in meaningful dialogue as to the applications/implications of their results.

TLO 4.1

Methods: agriculture graduates will possess some knowledge of communication theory and understand the importance of professional networks. They will understand that communication is a two-way process of imparting, questioning and receiving information that requires cultural competence with a range of audiences. They will be able to present data in a variety of ways, including charts, graphs and symbols, which clearly show the trends or conclusions from their analysis as well as the accuracy of the underlying data. They will also be able to enter into dialogue on the applications/implications of their analysis.

TLO 4.2

Range of audiences: agriculture graduates will be able to communicate with their peers, industry, experts in other fields and the general community.

Variety of modes: agriculture graduates will communicate using a range of media, including both written and oral, and a variety of other techniques. Such communication could include a range of formats (e.g. technical and client reports, newspaper or journal articles, poster presentations, wikis, blogs, podcasts, etc.).

Notes on the TLOs: professional and personal responsibility

Professional and personal responsibility

TLO 5.1

Independent and self-directed: agriculture graduates will take responsibility for their own learning. They will be able to work autonomously and evaluate their own performance. For agriculture graduates to make an ongoing contribution to a society in which scientific knowledge is continually evolving, it is important that they are motivated to continue to learn after graduation and to maintain the currency of their professional practice. This is also referred to as life-long learning.

TLO 5.2

Working effectively, responsibly and safely: agriculture graduates will understand how to take responsibility for themselves and others in their professional practice, including how to meet workplace health and safety requirements. This includes, for example, an understanding of time management and the onus on an individual to fulfil their role as part of a team project. Graduates will have an awareness of the mental and physical health of both themselves and others.

Individual context: agriculture graduates will be able to work independently with limited supervision. They will seek advice when needed, and be able to act upon such advice.

Team context: agriculture graduates will have gained the employability skills to function effectively as members or leaders of scientific or multidisciplinary teams. They will understand that agriculture is primarily a collaborative activity.

TLO 5.3

Regulatory frameworks relevant to their specialist area: agriculture graduates will have an awareness of the regulatory frameworks that apply to their sub-discipline area. These might be the legal frameworks for experimentation and data collection, quarantine, quality control procedures, or the necessity to obtain government permits for certain types of activity. Graduates will be prepared to abide by these regulatory frameworks as they move into professional employment, and understand the consequences of not doing so.

TLO 5.4

Ethical conduct: agriculture graduates will have demonstrated that they have learned to behave in an ethical manner during their period of undergraduate study. They will be equipped to do so into the future and to meet social and professional expectations. This might include accurate data recording and storage, appropriate referencing and avoidance of plagiarism, intellectual integrity, animal ethics, gene flow, or human ethics. Graduates will have a sense of commitment to truth and to the integrity of science.

Degrees in agriculture provide a wide range of knowledge and skills across broad subject areas, allowing career flexibility for graduates.

Reference group and membership

Terms of reference

The reference group will support the implementation of the Agriculture Learning and Teaching Academic Standards (AgLTAS) project as defined in the project plan. The reference group is convened by the project leader. The focus of the reference group will be Threshold Leaning Outcomes (TLOs) for agriculture graduates at bachelor degree level. Key tasks include:

- Provide advice to the project leader on the direction and implementation of the AgLTAS project
- Review drafts of project-related material, including the TLOs
- Assist the project leader in communicating and engaging commitment across the agriculture discipline community and relevant stakeholders
- Consider and approve the draft TLOs prior to their dissemination to the broader discipline communities and facilitate such dissemination
- Consider and endorse the final TLOs for reporting to the Office for Learning and Teaching (OLT)
- Facilitate dissemination of the TLOs developed by this project
- Provide expert advice to the project leader and the OLT on the next steps to be undertaken once the TLOs for agriculture undergraduate degrees have been supported by the Australian Council of Deans of Agriculture.

Membership

Academic representatives

Professor Susan Jones	Professor Emeritus, University of Tasmania. ALTC Discipline Scholar for Science.
Professor Roger Leigh	Deputy Head of School (Research), Waite Research Institute, School of Agriculture, Food and Wine, The University of Adelaide. Chair, National Committee for Agriculture, Fisheries and Food, Australian Academy of Sciences.
Dr Andrea Crampton	Senior Lecturer, School of Biomedical Sciences, Charles Sturt University.

Industry representatives

Mr Geoff Thomas	Thomas Project Services, Ag Institute of Australia.
Mr Ian Macleod	Managing Director, Peracto.

Student representative

Ms Nysha Munroe	Research Higher Degree Candidate, University of Tasmania.

External evaluator

Professor Elizabeth Johnson	Pro Vice-Chancellor, Teaching and Learning, Deakin University.

Consultation and development process

Ethics

Ethics approval for data collection was gained from the University of Tasmania Social Sciences Human Ethics Research Committee before the start of the project (HREC 13526). Partner universities in the AgLTAS project (The University of Adelaide, Charles Sturt University and University of Western Sydney) gained ethics approval from their respective institutions.

Participants

For the purposes of the project, 'academics' were defined as participants who identified as being employed in the tertiary sector. 'Industry' stakeholders then by default encompassed other roles in agriculture exclusive of academics in higher education in both the public (e.g. state departments of agriculture; Australian government departments and research organisations with an agricultural focus) and private sector (e.g. agribusiness; research, development and extension providers). Recent graduates were not identified in the project as a discrete stakeholder group and these participants instead self-selected into either the academic or industry cohorts.

Consultation process

Project team members organised consultation workshops within their own and other universities and with members of their professional networks. These were undertaken from September 2013 to March 2014 (Table 1).

Participants, recruited from students, academics and industry stakeholder groups, were exposed to a draft AgLTAS Statement. Structured questions and activities were designed to gain feedback on the core elements of the Statement (nature and extent of the discipline, and TLOs). The design of questions for the workshops was based on the different cognitive skills that stakeholders would use to answer questions about the Statement. A national online survey was also administered via the project website (www.agltas.edu.au).

Workshops and surveys were undertaken in several stages. The first stage was designed to ensure that the understanding of different parts of the AgLTAS Statement and relationships between them was clear and facilitated participants synthesising their own and others' viewpoints. This ensured alignment of project purpose with project method, so that questions and tasks designed to facilitate collaborative discussion would result in data targeted towards informing the redrafting of the Statement. The second stage was directed towards eliciting participants' 'analyses' and their 'evaluations' of those expectations. Finally, participants were asked to analyse the AgLTAS draft Statement.

Drafting the agriculture standards statement

The reference group and project team used Bloom's taxonomy of cognition to provide a conceptual framework that guided the analysis of the aggregated participant responses to the pilot draft to structure the process of redrafting the AgLTAS Statement. This process began on 25 November 2013.

Bloom's taxonomy[8] is widely used in education to classify learning objectives in terms of a progression from lower to higher orders of thinking. The taxonomy has six levels:

1) Knowledge
2) Comprehension (understanding)
3) Application
4) Analysis
5) Synthesis
6) Evaluation (judgement).

Embedding Bloom's taxonomy in Table 2 provided a structure for collecting and analysing participant responses as data, and provided a transparent process that enabled the project team to explain and justify decisions on which TLOs would be included in the final version of the AgLTAS Statement.

[8] *Bloom BH, Englehart MD, Furst EJ, Hill WH & Krathwohl DR. (1956). Taxonomy of Educational Objectives: Handbook 1. Cognitive Domain. New York: David McKay Company Inc.*

The consultation activity stream was designed to allow participants to:

1) Articulate their knowledge and understanding of agriculture.

2) Apply that knowledge to the task of drafting a consensus Standards Statement by evaluating the current draft.

The intended outcomes of the drafting activity stream were for the project team to:

1) Analyse participant data to demonstrate knowledge and understanding of the different perspectives on the form and content of an AgLTAS Statement.

2) Apply that knowledge to draft new versions of the Statement.

Each draft was also evaluated to determine how accurately it reflected the consensus view emerging from the consultation activity stream. The evaluation process was a necessary benchmark prior to the activity of synthesising the data into the statement on the nature and extent of the discipline and the agriculture TLOs, which were presented to the ACDA for their support on the 9 April 2014.

Explanatory notes for the Agriculture TLOs were developed by the project team and reference group in consultation with academics at the four partner universities.

Mapping was undertaken to show how the agriculture TLOs aligned with the science TLOs, Australian Qualifications Framework (AQF) level 7 descriptors and the UK Quality Assurance Agency for Higher Education (QAA) subject benchmark for agriculture, horticulture, forestry, food and consumer sciences[9] as an international benchmark (see page 20).

The final version of the AgLTAS Statement was presented to ACDA on 4 November 2014.

Table 1: Stakeholder groups and number of participants who took part in the online survey and workshops. Participants in stages 1 and 2 commented on different versions of the AgLTAS Statement.

Location	Stakeholder Group	Activity	Participants No.	Date
University of Tasmania	A	W	11	7 May 12*
The University of Adelaide (BAgSci)	S	W	21	20 Sep 13
The University of Adelaide (Viticulture)	A	W	10	23 Sep 13
The University of Adelaide (Agriculture)	A	W	10	30 Sep 13
SA Industry	I	W	7	30 Sep 13
SA Agricultural Consultants Group	I	W	15	30 Sep 13
University of Tasmania student forum	S	S	20	4 Oct 13
TAS Industry	I	W	7	15 Oct 13
University of Tasmania Alumni/Industry	I	W	21	25 Oct 13
University of Western Sydney 1	S	W	12	25 Oct 13
Online 1	V	S	27	7 Nov 13
University of Queensland	A	W	7	11 Nov 13
CSIRO & RDCs, ACT	I	W	14	18 Nov 13
Charles Sturt University, Wagga Wagga	A	W	7	21 Nov 13
Charles Sturt University, Orange	A	W	8	2 Dec 13
University of New England	A	W	7	3 Dec 13
La Trobe University & Melbourne University	A	W	7	10 Dec 13
Curtin University	A	W	10	4 Feb 14
University of Western Australia	A	W	17	4 Feb 14
University of Western Sydney 2	A	W	16	20 Feb 14
Online 2	V	V	18	2 Mar 14
Murdoch University	A	Sub	1	7 Mar 14
NSW Industry	I	W	7	14 Mar 14
University of Sydney	A	W	10	20 Mar 14
Total			**290**	

Abbreviations: Stakeholder groups: A, Academics; I, Industry; S, Students; V, various. Activity: S, survey; Sub, submission; W, workshop.

** Run as part of the pilot project*

[9] *UK Quality Assurance Agency for Higher Education. (2009). Subject Benchmark Statement. Agriculture, Horticulture, Forestry, Food and Consumer Sciences. Gloucester, UK: Quality Assurance Agency for Higher Education.*

Table 2: Activity streams (consultation; drafting the AgLTAS Statement) aligned with Bloom's taxonomy. Modified from Botwright Acuña et al. (2014)[9].

Cognitive Skill	Consultation activity stream: academics, students, industry	Drafting AgLTAS Statement activity stream: project team, project leader, reference group
1. Knowledge	**Step C1: workshop part 1; survey:** What do participants know, understand and do with respect to their own expectations about what graduates of agriculture know, understand and can do	**Step D1:** Appreciation of participants' knowledge, understanding and application of what graduates of agriculture know, understand and can do from their perspective in a workshop setting, reserving judgement (project team)
2. Understanding		
3. Application		**Step D2:** Preparation of summaries from individual workshops (project team)
4. Analysis	**Step C2: workshop part 2:** Discussion by participants in workshops and free text survey comments	**Step D3:** Thematic analysis of collated feedback from participants (project leader)
5. Evaluation	**Step C3: workshop part 3:** Shared judgements about what graduates of agriculture know, understand and can do in workshops by participants	**Step D4:** Judgement made without bias by the project team on the value of the project TLOs on what graduates of agriculture know, understand and can do, based on collated feedback (reference group)
6. Synthesis	**Step C4: presentation to stakeholders:** Shared understanding across stakeholders: AgLTAS Statement that is representative of the majority of participants	**Step D5:** Synthesis of the AgLTAS Statement: A TLO for what graduates of agriculture know, understand and can do; explored further in explanatory notes (reference group, project leader, project team)

[9] *Botwright Acuña TL, Kelder J, Able AJ, Guisard Y, Bellotti, McDonald G, Doyle R, Wormell P & Meinke H. (2014). Academic, Industry and Student Perspectives on the Inclusion of "Vocational Knowledge" in a 'Learning and Teaching Academic Standards Statement' for Agriculture. Journal of Learning Design 7: 1–15.*


Graduates must be life-long
learners, capable of undertaking
continued professional
development to practice
agriculture as professionals.

Alignment of bachelor-level TLOs in agriculture with national and international comparators

The TLOs describe a pass-level graduate from a bachelor degree program. A 'bachelor degree' is defined according to the Australian Qualifications Framework (AQF), within which it represents a level 7 qualification. This provides a comparison of the agriculture TLOs with those for science, the AQF and the UK Quality Assured Agency subject benchmark for agriculture, horticulture, forestry, food and consumer sciences.

AgLTAS	Science LTAS	AQF Level 7	UK QAA Agriculture, horticulture, forestry, food and consumer sciences
1. Demonstrate an integrative understanding of agriculture by:	**1. Demonstrate a coherent understanding of science by:**	**Graduates of a bachelor degree...**	**Understanding**
1.1 Explaining the role and relevance of agriculture and its related sciences, and agribusiness in society.	1.1 Explaining the role and relevance of science in society.	**...will have:** A broad and coherent body of knowledge	• the relevance and application of the subject • the development of integrated, multidisciplinary and interdisciplinary approaches • integration of theory, experiment, investigation and fieldwork, and the development of principles into practice • quantitative and qualitative approaches to information • awareness of risks of exploitation and concern over sustainable solutions • consideration of continuing change and development of the subject.
1.2 Understanding the major biophysical, economic, social and policy drivers that underpin agricultural practice and how they contribute to practice change.	1.2 Articulating the methods of science and explaining why current scientific knowledge is both contestable and testable by further inquiry		
1.3 Understanding how information is adopted and the context within which producers, processors and consumers, make decisions.			
2. Exhibit depth and breadth of knowledge of agriculture by:	**2. Exhibit depth and breadth of scientific knowledge by:**	**Graduates of a bachelor degree...**	**Knowledge**
2.1 Demonstrating knowledge of the core sciences in the context of agriculture.		**...will have:** A broad and coherent body of knowledge, with depth in the underlying principles and concepts in one or more disciplines as a basis for independent lifelong learning Cognitive and technical skills to demonstrate a broad understanding of knowledge with depth in some areas	• the underlying principles of the subject • its relevant defining concepts, theories and methods • the current knowledge and development of the subject • identification of current gaps in knowledge or understanding and current issues of wider concern to society and the world • the global, regional and local contexts of the topic • the location of resources, and the management, exploitation and pattern of utilisation of resources within socio-economic, policy and legal frameworks • subject-specific and key skills, problem-solving and a professional approach to study and lifelong learning • an understanding of issues of sustainability and environmental impact.
2.2 Demonstrating broad generalist knowledge of relevant agricultural production systems and their value chains, with specialist knowledge in at least one area.	2.1 Demonstrating well-developed knowledge in at least one disciplinary area		
2.3 Understanding how knowledge from different sub-disciplines within agriculture is integrated and applied into practice.	2.2 Demonstrating knowledge in at least one other disciplinary area.		
2.4 Demonstrating a basic knowledge of economics, business and social science as they apply to agriculture.			

AgLTAS	Science LTAS	AQF Level 7	UK QAA Agriculture, horticulture, forestry, food and consumer sciences
3. Critically analyse and address dynamic complex problems in agriculture by:	**3. Critically analyse and solve scientific problems by:**	**Graduates of a bachelor degree...**	
3.1 Identifying contemporary issues and opportunities in agriculture.			
3.2 Gathering, critically evaluating and synthesising information from a range of relevant sources and disciplines.	3.1 Gathering, synthesising and critically evaluating information from a range of source	**...will have:** Cognitive skills to review, critically analyse, consolidate and synthesise knowledge	**Intellectual skills** • recognising and using appropriate theories, concepts and principles from a range of disciplines • collecting and integrating several lines of evidence to develop balanced arguments • designing an experiment, investigation, survey or other means to test a hypothesis or proposition • critically analysing information, synthesising and summarising the outcomes • applying knowledge and understanding to address multidisciplinary problems • creativity and innovation • demonstrating awareness of the provisional nature of the facts and principles associated with a field of study • decision making in complex and unpredictable contexts.
3.3 Selecting and applying appropriate and/or theoretical techniques or tools in order to conduct an investigation.	3.2 Designing and planning an investigation	**...will have:** Cognitive and creative skills to exercise critical thinking and judgement in identifying and solving problems with intellectual independence	**Practical skills** • planning, conducting and reporting on investigations, including the use of secondary data • collecting and recording diverse types of information generated by a wide range of methodologies and summarising it using appropriate qualitative and/or quantitative techniques • devising, planning and undertaking field, laboratory or other investigations in a responsible, sensitive and safe manner, paying due diligence to risk assessment; ethical and data protection issues; rights of access; relevant health and safety regulations; legal requirements; and the impact of investigations on the environment • appreciating and analysing financial and other management information and using it in decision-making.
3.4 Collecting, accurately recording, analysing, interpreting and reporting data.	3.4 Collecting, accurately recording, interpreting and drawing conclusions from scientific data.	**...will have:** Cognitive and technical skills to demonstrate a broad understanding of knowledge with depth in some areas **...will demonstrate the application of knowledge and skills:** with initiative and judgement in planning, problem solving and decision making in professional practice and/or scholarship to adapt knowledge and skills in diverse contexts	**Numeracy skills** • appreciating issues of sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field, laboratory or collated from secondary sources • appreciating the difficulties of having incomplete information on which to base decisions • understanding the nature of risk • preparing, processing, interpreting and presenting data, using appropriate qualitative and quantitative techniques and packages solving numerical problems using computer-based and other techniques.

AgLTAS	Science LTAS	AQF Level 7	UK QAA Agriculture, horticulture, forestry, food and consumer sciences
4. Be effective communicators by:	**4. Be effective communicators of science by:**	**Graduates of a bachelor degree...**	**Communication skills**
4.1 Understanding methods of effective two-way written and verbal communication with different audiences.			• receiving, evaluating and responding to a variety of information sources (that is, electronic, textual, numerical, verbal, graphical) • communicating accurately, clearly, concisely, confidently and appropriately to a variety of audiences in written, verbal and graphical forms
4.2 Communicating with a range of audiences in an agricultural context using a variety of modes.	4.1 Communicating scientific results, information, or arguments, to a range of audiences, for a range of purposes, and using a variety of modes.	**...will have:** Communication skills to present a clear, coherent and independent exposition of knowledge and ideas	• contributing constructively to group discussions • considering, appreciating and evaluating the views of others.
5. Be accountable for their own learning and professional work by:	**5. Be accountable for their own learning and scientific work by:**	**Graduates of a bachelor degree...**	
5.1 Being independent and self-directed learners.	5.1 Being independent and self-directed learners	**...will have:** A broad and coherent body of knowledge....as a basis for independent lifelong learning	**Self-management and professional development skills** • appreciating the need for professional codes of conduct where applicable • recognising the moral, ethical and social issues related to the subject • assuming responsibility for one's actions • identifying and working towards targets for personal, academic and career development • developing an adaptable and flexible approach to study and work • developing the skills necessary for self-managed and lifelong learning (that is working independently, time-management and organisation skills) • demonstrating the competence, behaviour and attitude required in a professional working life, including initiative, leadership and team skills.
5.2 Working effectively, responsibly and safely in an individual and team context.	5.2 Working effectively, responsibly and safely in an individual or team context		**Interpersonal and teamwork skills** • organising teamwork and participating effectively in a team • setting realistic targets • identifying individual and collective goals and responsibilities • planning, allocating and evaluating the work of self, individuals and teams • performing in a manner appropriate to allocated roles and responsibilities • recognising and respecting the views and opinions of other team members • having positive intent • reflecting on and evaluating own performance as an individual or as a team member.
5.3 Demonstrating knowledge of the regulatory frameworks relevant to their specialist area in agriculture. 5.4 Personally practising ethical conduct.	5.3 Demonstrating knowledge of the regulatory frameworks relevant to their disciplinary area and personally practising ethical conduct.	**...will demonstrate the application of knowledge and skills:** With responsibility and accountability for own learning and professional practice and in collaboration with others within broad parameter.	

Abbreviations

ACDA	Australian Council of Deans of Agriculture
AQF	Australian Qualifications Framework
HREC	Human Ethics Research Committee
LTAS	Learning and Teaching Academic Standards
OLT	Office for Learning and Teaching
QAA	Quality Assurance Agency for Higher Education, UK
TEQSA	Tertiary Education Quality and Standards Agency
TLOs	Threshold Learning Outcomes

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