Shape of ACT Senior Secondary Curriculum

Automotive Technology A/M/V

April 2022

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1. PURPOSE

1.1 The *Shape of ACT Senior Secondary Curriculum: Automotive Technology* will guide the writing of the updated *Automotive Technology A/M/V* course.

1.2 This paper has been prepared following the deliberations of the *Automotive Technology* writing team and also in consultation with Bryce Mitchell of the Canberra Institute of Technology and Michael Patton of Southern Automotive Services Tuggeranong.

1.3 The paper should be read in conjunction with *The Shape of the ACT Senior Secondary Curriculum* located at: *http://www.bsss.act.edu.au/curriculum/bsss_course_development_consultation*

2. INTRODUCTION

2.1 The *Automotive Technology A/M/V* course will be the basis of planning, teaching, learning and assessment in ACT senior secondary schools.

2.2 The course makes provision for qualifications or a Statement of Attainment from the Automotive, Retail, Service and Repair Training Package.

Refer to https://training.gov.au/Training/Details/AUR

3. BACKGROUND

3.1 The ACT Board of Senior Secondary Studies is reviewing the *Automotive Technology* A/M/V curriculum in the five-year course development cycle of improvement.

3.2 *Automotive Technology A/M/V* is a discreet subject that develops significant skills, knowledge, and understandings for working in the automotive industry, as well as a range of general capabilities to pursue a range of future occupations and life aspirations. In its developed form, this course will be contemporary and highly relevant to senior secondary students in the twenty-first century.

3.3 All courses under development are required to meet Board design specifications and to align with Board requirements for the senior secondary curriculum. These specifications align with ACARA course design specifications and provide teachers with flexibility to plan, teach and assess according to the needs and interests of their students.

3.4 The *Automotive Technology A/M/V* course is a highly practical course, and to facilitate delivery, it is to be developed under the *Industry and Services Framework*, which prioritises practical applications. The Framework is located at:

http://www.bsss.act.edu.au/__data/assets/pdf_file/0010/411022/Industry_and_Services_Framework.pdf

The rationale for this framework describes Industry and Services courses as:

> *Courses written under this framework provide students with knowledge, understanding and skills relating to areas of work inside the industry & services domains. In broad terms, students learn about industry practices, processes, procedures, and concepts such as technical information, materials, sustainability, equipment, and work health & safety (WHS). Students learn to analyse, problem solve, make decisions, and develop interpersonal and intrapersonal skills suitable for employment and further training.*

3.5 All courses written under this framework should enable students to:

- analyse industry practices, processes, and procedures
- analyse technical information and specifications
- understand materials and equipment
- demonstrate industry specific literacy and numeracy skills
- solve problems and use industry specific terminology
- organise resources and material to create quality products and services

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- work independently and collaboratively in accordance with WHS principles and industry standards
- communicate in a range of modes and mediums.

Courses developed under this Framework provide details of course content through the component units of the course. While this content will differ according to the particular course, all content will be chosen to enable students to work towards the achievement of the common and agreed goals of the Framework.

3.6 Concepts, knowledge and skills from the Industry and Services Framework:

Concepts and knowledge

- industry practices, processes, concepts, and procedures
- technical information and terminology
- materials and equipment
- Workplace Health and Safety Skills.

Skills

- analysing and evaluating
- problem solving
- decision making
- reflecting on own learning
- industry specific literacy and numeracy
- interpersonal and intrapersonal strategies communication.

3.7 All courses of study for the ACT Senior Secondary Certificate should enable students to develop essential capabilities for twenty-first century learners. The Australian Curriculum General Capabilities comprise an integrated and interconnected set of knowledge, skills, behaviours, and dispositions that students develop and use in their learning across the curriculum.

Students in *Automotive Technology A/M/V* engage with the General Capability of Critical and Creative Thinking through examination of information and data and through problem solving.

> *In the Australian Curriculum, students develop capability in critical and creative thinking as they learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives, and solve problems. Critical and creative thinking involves students thinking broadly and deeply using skills, behaviours, and dispositions such as reason, logic, resourcefulness, imagination, and innovation in all learning areas at school and in their lives beyond school.*
> https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/critical-and-creative-thinking/

Students in *Automotive Technology A/M/V* engage with the General Capability of Literacy as they engage with a variety of texts for purpose and communicate information for understanding.

> *In the Australian Curriculum, students become literate as they develop the knowledge, skills, and dispositions to interpret and use language confidently for learning and communicating in and out of school and for participating effectively in society. Literacy involves students listening to, reading, viewing, speaking, writing, and creating oral, print, visual and digital texts, and using and modifying language for different purposes in a range of contexts.*
>
> https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/literacy/

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Students in *Automotive Technology A/M/V* engage with the General Capability of Information and Communication Technology through develop of skills with digital technologies for the maintenance, service, and repairs of vehicles.

> *In the Australian Curriculum, students develop Information and Communication Technology (ICT) capability as they learn to use ICT effectively and appropriately to access, create and communicate information and ideas, solve problems, and work collaboratively in all learning areas at school and in their lives beyond school. ICT capability involves students learning to make the most of the digital technologies available to them, adapting to new ways of doing things as technologies evolve and limiting the risks to themselves and others in a digital environment.*
>
> https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/information-and-communication-technology-ict-capability/

Students of *Automotive Technology A/M/V* will engage with the General Capability of Numeracy through generating, analysing, and interpreting data. They implement skills in the measurement of materials.

> *In the Australian Curriculum, students become numerate as they develop the knowledge and skills to use mathematics confidently across other learning areas at school and in their lives more broadly. Numeracy encompasses the knowledge, skills, behaviours, and dispositions that students need to use mathematics in a wide range of situations. It involves students recognising and understanding the role of mathematics in the world and having the dispositions and capacities to use mathematical knowledge and skills purposefully.*
>
> https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/numeracy/

3.8 The importance of the senior years of schooling as a critical transition point for young people is highlighted in two extracts from the *Alice Springs (Mparntwe) Education Declaration*:

> *All Australian Governments and the education community need to support students in their senior years by helping them acquire the cognitive and social skills necessary for life after school and equip students to remain engaged in learning throughout life.*
>
> *Australian Governments commit to working with the education community to provide a senior secondary education that equips young people with the skills, knowledge, values, and capabilities to succeed in employment, personal and civic life.*
>
> *https://docs.education.gov.au/documents/alice-springs-mparntwe-education-declaration*

4. THE CONTEXT OF THE ACT

4.1 Courses of study for the ACT Senior Secondary Certificate:

- provide a variety of pathways, to meet different learning needs and encourage students to complete their secondary education
- enable students to develop the essential capabilities for twenty-first century learners
- empower students as active participants in their own learning
- engage students in contemporary issues relevant to their lives
- foster students' intellectual, social, and ethical development
- nurture students' wellbeing, and physical and spiritual development
- enable effective and respectful participation in a diverse society.

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4.2 Each course of study:

- comprises an integrated and interconnected set of knowledge, skills, behaviours, and dispositions that students develop and use in their learning across the curriculum
- is based on a model of learning that integrates intended student outcomes, pedagogy, and assessment
- outlines teaching strategies which are grounded in learning principles and encompass quality teaching
- promotes intellectual quality, establishes a rich learning environment, and generates relevant connections between learning and life experiences
- provides formal assessment and certification of students' achievements.

4.3 In consideration of the ACT context, and in response to contemporary research and literature, the *Automotive Technology* curriculum should include:

- a student-centred pedagogical approach
- the educational needs of young people with respect to automotive skills, knowledge, processes, and industry practices
- procedures to safely undertake work in the automotive repairs industry
- industry specific literacy and numeracy skills
- working collaboratively and independently
- communicating with others from diverse backgrounds and for a range of purposes
- the Industry and Services Framework and Achievement Standards
- the needs of different schools and sectors (government and non-government)
- awareness of local, national, and global issues
- ethical, environmental and sustainability factors.

5. AIMS OF THE AUTOMOTIVE TECHNOLOGY CURRICULUM

5.1 *Automotive Technology A/M/V* is a course which develops the knowledge, skills and understanding required to undertake work and further study within the technical automotive industry. The automotive industry is one currently undergoing revolutionary change with the advancement of electric componentry and alternative fuel technologies. As such 'with vehicles becoming increasingly more complex, workshop technicians, or mechanics as we know them, will not only have to be able to work on brakes, suspension, and the like, but also have the necessary tech skills to manage high tech cars which are literally becoming like a computer on wheels. There is no doubt the motor industry has much to offer enthusiastic young, bright people eager to learn.' (Creamer Media 2020)

Automotive technology is an innovative and dynamic sector that now encompasses the Sciences, Technology, Engineering and Mathematical (STEM) concepts. The Economic Growth Institute, University of Michigan (2020) reports 'the skillsets required to work on a vehicle have drastically changed over the last 30 years. Before the 21st century, cars were mostly mechanical and simple maintenance and troubleshooting could often be completed by hobby mechanics. As vehicle technology developed, however, the number of electronic, electrical and software components increased, as well as the associated skillsets required for those working on them and as such the demanded skillsets of technicians are evolving as quickly as the vehicle.'

Understanding these industry changes, *Automotive Technology A/M/V* enables students to engage in the advanced technologies integral to modern transportation and attain the skills necessary for their maintenance and servicing. Lazaros (2014, 15) further supports the need for education and training to shift focus further into the technological components as 'automotive service technicians and mechanics are involved with servicing the technological systems of engines, transmissions, and drive

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belts… and because of the advances in automotive technology must also be familiar with computer-controlled systems in vehicles and electronic components.'

In meeting the current industry requirements, the Industry and Skills Committee identifies that the consistent change and evolution of technology in the automotive industry means the technical skills required to keep pace are a key focus for the sector. Industry consultation and previous research, as highlighted in the *Automotive IRC's 2019 Skills Forecast*, identifies significant skills demand in the industry for the following: fault diagnosis skills, mechanical and electrical repair skills for modern vehicle systems, including semi-automatic driving technologies like: park assist, lane departure warning, and autonomous emergency braking. The *Automotive Technology A/M/V* course, as such, should develop students understanding and knowledge associated with these technologically advanced systems and other existing and emerging technologies within the industry as to develop the skills to foster the continued innovation required to meet improved environmental and sustainable outcomes that reflect consumer demands.

In fully understanding the significant advancements within this field, students of *Automotive Technology A/M/V* develop fundamental skills in traditional vehicle maintenance and servicing. Technological advancements in systems and tools are examined, compared, and experienced where appropriate.

Students of *Automotive Technology A/M/V* develop *'Artisan'* skills around manual tasks, and maintenance (The New Work Mindset 2017) whilst are also offered opportunities to develop critical and creative thinking, problem solving, teamwork and, communication skills when solving automotive problems as expected of future industry employees and professionals. These 'Artisan' and general capability skills are provided in simulated workplace environments and, where possible, industry placements as to provide real world opportunities for students to assess and solve problems.

5.2 The *Automotive Technology* course enables students to:

- demonstrate automotive repair and maintenance skills
- develop automotive systems knowledge and understandings
- implement and undertake sustainable practices
- plan, adapt and implement automotive processes
- identify automotive systems faults and make considered repairs
- develop skills in the selection of tools and equipment for automotive industry purposes
- develop skills in the selection and use of automotive technology and resources
- demonstrate critical thinking and problem-solving ability
- evaluate industry practices and processes
- explain and apply Workplace Health and Safety legislation, rules, and procedures in automotive technology contexts
- demonstrate personal and interpersonal skills, including teamwork, communication skills and customer service
- develop and apply ICT skills

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6. STRUCTURE OF THE AUTOMOTIVE CURRICULUM

RATIONALE

Automotive Technology A/M/V develops the knowledge, understandings and skills that underpin the automotive technology industry. Students investigate automotive components, systems, and technologies, understanding their interactions and relationships. They examine new and emerging technologies which impact the automotive industry, the careers available and the changing skill sets required for their implementation.

Students explore the automotive industry including business, occupations, future directions, and trends. They apply industry practices and processes for a variety of purpose are explored and applied across a range of subsets within the industry and as such allows for investigation in a diverse range of occupations within the sector.

Through both individual and collaborative learning experiences, students learn to meet employer expectations and establish productive and appropriate work habits. Participating in industry specific tasks promotes the development of adaptable, competent, self-motivated individuals who consider safety and work collaboratively with colleagues.

Students develop skills in communicating orally, and in written and graphical modes and apply these to industry requirements such as writing reports and in customer service applications.

They plan, select, and organize parts and processes to achieve desired automotive outcomes when diagnosing, repairing, and maintaining automotive systems, taking into consideration sustainable practices and environmental considerations.

Students develop relevant technical, vocational, and interpersonal competencies suitable for employment and further training in the automotive industry. They develop employability skills such as communication and teamwork which are transferable to other industry areas. Through the study of this subject, students will gain experiences that can be applied in a range of contexts, including work, study, and recreation.

The *Automotive Technology A/M/V* course provides opportunities to complete VET qualifications or a Statement of Attainment from the Automotive, Retail, Service and Repair Training Package (AUR).

UNITS

(May be studied in any order)

Vehicle Components and Systems

In this unit students explore the components that make up vehicles. They investigate the function of various traditional and modern components and systems, using problem skills to identify functional concern and conduct fault diagnosis. Students develop skills utilising industry specific equipment, practices and tools in the maintenance and repair of vehicle components and systems such as tyres, suspension, and brakes in-line with WHS practices. They investigate the repair and maintenance of components, proposing and considering environmental and sustainable practices. Students investigate advancements in vehicle components and the implications for repair or replacement.

Electrical Automotive Systems

This unit offers opportunities for students to investigate the varied electrical systems and their configurations that are found within the automotive industry. Students develop knowledge and understanding of systems when diagnosing faults and failures. They apply skills for repairs using appropriate tools and techniques in line with WHS practices. They examine the nature, purpose, and differences of interrelated automotive electrical systems in traditional and modern vehicles.

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Automotive Principles

This unit offers opportunities for students to investigate the varied and complex mechanical systems that are found within engines. Students develop knowledge and understanding of systems when diagnosing engine faults and failures. They evaluate and apply skills for repairs using appropriate tools and techniques in line with WHS practices. They examine the nature, purpose, and differences of interrelated automotive mechanical systems in traditional and modern vehicles.

Automotive Powertrain Systems

This unit provides opportunities for students to investigate and explore the various existing and emerging powertrain systems used in vehicles. They develop an understanding of fuels and energy sources, their composition, advantages, disadvantages, including environmental and sustainable consideration. They investigate the different mechanical systems associated with different powertrain systems, such as petrol, diesel, and other powertrain systems, and develop skills in their maintenance and repair. Energy sources are explored for comparison and skills developed in simulated or industry context.

Independent Study

An Independent Study unit has an important place in senior secondary courses. It is a valuable pedagogical approach that empowers students to make decisions about their own learning. An Independent Study unit can be proposed by an individual student for their own independent study and negotiated with their teacher. The program of learning for an Independent Study unit must meet the unit goals and content descriptions as they appear in the course.

Independent study units are only available to individual students in Year 12 who have completed at least three standard 1.0 units from the course. A student can only study a maximum of one Independent Study unit in each course.

An Independent Study unit requires the principal's written approval.

Please note: Training Package requirements for students seeking VET qualifications through the Automotive Retail, Service and Repair Training Package (AUR) must still be met.

7. CONSIDERATIONS

7.1 Incorporating a futures orientation

The Future of Education and Skills Education 2030 stresses the importance of being future focused in the development of curriculum for schools. The *Automotive Technology* course has a futures orientation in addressing the growing need for young people to be innovative, knowledgeable, skilled, and adaptable:

> *The concept of competency implies more than just the acquisition of knowledge and skills; it involves the mobilisation of knowledge, skills, attitudes, and values to meet complex demands. Future-ready students will need both broad and specialised knowledge. Disciplinary knowledge will continue to be important, as the raw material from which new knowledge is developed, together with the capacity to think across the boundaries of disciplines and "connect the dots".*
>
> *http://www.oecd.org/education/2030-project/contact/E2030_Position_Paper_(05.04.2018).pdf*

The course does more than prepare students for the world of work. It enables students to develop the essential capabilities for twenty-first century learners:

> *Education has a vital role to play in developing the knowledge, skills, attitudes, and values that enable people to contribute to and benefit from an inclusive and sustainable future. Learning to form clear and purposeful goals, work with others with different perspectives, find untapped opportunities and identify multiple solutions to big problems will be essential in the coming years. Education needs to aim to do more than prepare young people for the world of work; it needs to equip students with the skills they need to become active, responsible, and engaged citizens.*

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http://www.oecd.org/education/2030-project/contact/E2030_Position_Paper_(05.04.2018).pdf

7.2 *Automotive Technology* curriculum

Automotive Technology has an important place in the ACT senior secondary curriculum. The curriculum promotes problem-solving and decision-making, and in studying *Automotive Technology* students are active participants in their own learning. Students are challenged to think about and respond to their work practices. Their personal and social development is fostered through working independently and collaboratively, and in the development of communication skills and intercultural awareness.

7.3 Equity and opportunity

The *Automotive Technology A/M/V* curriculum is inclusive of students' needs and interests. It provides flexibility and choice for teachers and students. The factors that influence this choice include school and community contexts, local community learning opportunities, contemporary and local issues, and available learning resources.

7.4 Role of digital technologies

Students and teachers integrate a range of information technology tools and applications for a variety of purposes. These include manuals, applications, business and diagnostic software and digitised online materials. Students use ICT tools for communication with a range of stakeholders and audiences.

7.5 Clarity of curriculum

The curriculum is substantial and flexible. It is sufficiently rich and descriptive to guide teachers with limited experience but avoids excessive prescription that would hamper experienced teachers from exercising their skills. The curriculum document is expressed clearly in terms that are accessible to a new teacher, while allowing all teachers to enhance it with their interests and expertise.

7.6 Breadth and depth of study

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all content descriptions.

A program of learning is what a college provides to implement the course for a subject meeting students' needs and interests. It is at the discretion of the teacher to emphasise some content descriptions over others. The teacher may teach additional (not listed) content if it meets the specific unit goals providing that it does not duplicate content in other units.

7.7 The nature of the learner

The course addresses the needs of diverse learners and caters for Accredited (A) and Modified (M) levels of study.

7.8 General capabilities

Skills and understanding related to numeracy, literacy and ICT are further developed and used in *Automotive Technology*, as are problem solving and creativity. Critical and creative thinking are developed when students explore problems, develop ideas, generate solutions, and evaluate and refine their ideas. They develop personal and social capability while working collaboratively and independently and build on self-management skills.

7.9 Cross curriculum perspectives

Each of the perspectives, Aboriginal and Torres Strait Islander histories and cultures, Asia and Australia's engagement with Asia, and Sustainability are represented in ways that are appropriate to in the course.

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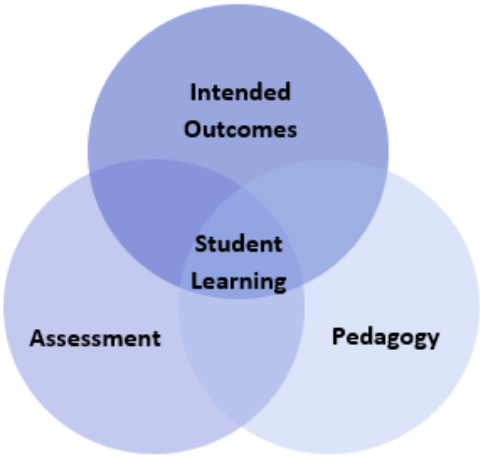
8. PEDAGOGY AND ASSESSMENT

The underpinning beliefs and learning principles for the development of the ACT Board of Senior Secondary School curriculum are as follows:

8.1 Underpinning beliefs

- All students are able to learn
- Learning is a partnership between students and teachers
- Teachers are responsible for advancing student learning.



8.2 Learning Principles

1. Learning builds on existing knowledge, understandings, and skills.

   (Prior knowledge)

2. When learning is organised around major concepts, principles, and significant real-world issues, within and across disciplines, it helps students make connections and build knowledge structures.

   (Deep knowledge and connectedness)

3. Learning is facilitated when students actively monitor their own learning and consciously develop ways of organising and applying knowledge within and across contexts.

   (Metacognition)

4. Learners' sense of self and motivation to learn affects learning.

   (Self-concept)

5. Learning needs to take place in a context of high expectations.

   (High expectations)

6. Learners learn in different ways and at different rates.

   (Individual differences)

7. Different cultural environments, including the use of language, shape learners' understandings and the way they learn.

   (Socio-cultural effects)

8. Learning is a social and collaborative function as well as an individual one.

   (Collaborative learning)

9. Learning is strengthened when learning outcomes and criteria for judging learning are made explicit and when students receive frequent feedback on their progress.

   (Explicit expectations and feedback).

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9. CONCLUSION

The *Automotive Technology A/M/V* course is to be developed under the *Industry and Services Framework*. Students develop an understanding of the automotive technology industry. They learn to analyse problem solve and justify solutions. The course equips students to engage confidently with appropriate technologies and to communicate appropriately to different audiences in a range of mediums. Students work both independently and collaboratively and develop interpersonal and intrapersonal skills suitable for employment and further training.

10. REFERENCES

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11. FURTHER READING

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