Australian Education Research Organisation

Early childhood learning trajectories: The evidence base

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The Australian Education Research Organisation (AERO) is Australia's national education evidence body, working towards excellent and equitable outcomes for all children and young people.

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Acknowledgement of Country

AERO acknowledges the traditional custodians of the lands, waterways, skies, islands and sea country across Australia. We pay our deepest respects to First Nations cultures and Elders past and present. We endeavour to continually value and learn from First Nations knowledges and educational practices.

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Abbreviations

Term	Explanation
ABLES	Abilities Based Learning and Education Support
ACARA	Australian Curriculum, Assessment and Reporting Authority
ACECQA	Australian Children's Education & Care Authority
AEDC	Australian Early Development Census
AGDE	Australian Government Department of Education
DEEWR	Department of Education, Employment and Workplace Relations
DET VIC	Victorian Department of Education and Training
ECEC	Early childhood education and care
EYLF	Early Years Learning Framework
EYT	Early Years Toolbox
IELS	International Early Learning and Child Well-being Study
KDC	Tasmanian Kindergarten Development Checklist
LFIN	Learning Framework in Number
NICHD	National Institute of Child Health and Human Development
OECD	Organisation for Economic Co-operation and Development
PASA	Pattern and Structure Assessment
PASMAP	Pattern and Structure Mathematical Awareness Program
PAT	Progressive Achievement Tests
PAT-M	Progressive Achievement Tests Mathematics
PAT-R	Progressive Achievement Tests Reading
PPC-T	Pretend Play Checklist
QCAA	Queensland Curriculum and Assessment Authority
QKLG	Queensland Kindergarten Learning Guideline
STEM	Science, technology, engineering and mathematics
ToM	Theory of Mind
VCAA	Victorian Curriculum and Assessment Authority
VEYLDF	Victorian Early Years and Development Framework

Introduction

The early childhood learning trajectories provide a translation of evidence on how children develop, incorporated into a clear, engaging resource for early childhood teachers and educators. This report summarises the evidence base that informed their development. It aims to deepen understanding of the domains of learning and development that the learning trajectories cover and show how they relate to early childhood assessment tools.

The learning trajectories describe learning and development in 5 key domains:

- Executive functions
- Social and emotional learning
- Mathematical thinking
- Language and communication
- Physical development.

Each trajectory unpacks the domain into its composite subdomains and strands and sets out 4 indicators for each strand that describe how learning progresses. Teachers and educators can use the indicators to focus their observations of children's learning during play and routines, and to interpret their observations and assessments. Using the learning trajectories systematically may also support teacher and educator professional learning. Each domain contributes to the learning outcomes of the Early Years Learning Framework (EYLF, EYLF V2.0) (Department of Education, Employment and Workplace Relations [DEEWR], 2009; Australian Government Department of Education [AGDE], 2022) and Victorian Early Years Learning and Development Framework (VEYLDF) (Victorian Department of Education and Training [DET VIC] & Victorian Curriculum and Assessment Authority [VCAA], 2016). This report draws on both the original EYLF and the revised edition, EYLF V2.0 released in January 2023.

The learning trajectories synthesise evidence and input from many different sources:

- Analysis of international learning trajectories and national outcomes measures for early childhood education and care (ECEC) undertaken by the Australian Education Research Organisation (AERO).
- Reviews of literature on how children learn and develop in each domain, conducted by expert researchers (led by Professors Susie Garvis and Caroline Cohrssen).
- Initial field trials and focus groups with 22 teachers and educators in Victoria, supported by the VCAA.
- Consultation with ECEC policymakers and sector leaders from across Australia through AERO's Project Advisory Group (PAG).
- Consultation with ECEC teachers, educators and leaders from across Australia through AERO's Panel of Educators, Teachers and Leaders (PETL).
- Mapping of the draft learning trajectories against other early childhood assessment tools by the Australian Council for Educational Research (ACER).

Each of these helped to ensure that the trajectories are rigorous, relevant and as useful as possible for teachers and educators in all Australian states and territories. Each step also generated valuable insights about how the trajectories can help improve the quality of ECEC practice. This report aims to demonstrate the strength of the evidence base for the trajectories, as well as to stimulate further exploration and reflection.

Insights from international examples

There is no 'one right way' to design a learning trajectory, and many different models exist. AERO's analysis of international examples identified features that all trajectories share, as well as optional elements that could be included. These are outlined below:

- **All trajectories describe distinct but interconnected domains**, although each names these domains differently. The domains covered in AERO's trajectories were identified as relevant and useful to Australian teachers and educators.
- **All trajectories describe progressions of learning and development within each domain** and give indicators that teachers and educators can use to describe children's progress. AERO's trajectories include subdomains, strands and indicators.
- **Most trajectories are linked to curriculum documents**, either tightly or loosely. AERO's trajectories are designed to link to approved learning frameworks for ECEC.
- **Some trajectories identify specific ages and milestones.** AERO's trajectories do not associate indicators with ages, recognising that each child's learning is unique.
- **Some trajectories identify specific behaviours for each domain**, which teachers and educators can look for. AERO's trajectories focus on the underlying learning and development that is occurring, which children can demonstrate in many ways.
- **Some trajectories include suggestions for practice to support each domain.** AERO's trajectories have broad suggestions for how to support each subdomain, but leave ample scope for evidence-based pedagogical decision-making.
- **Some trajectories are used as documentation**, with space for teachers, educators and families to record observations. AERO's trajectories are designed to be read and reflected upon to inform other documentation, without adding to paperwork.

Examples of other learning trajectories (sometimes called learning progressions) are detailed below. They provide a snapshot of the different approaches outlined above. Other examples of learning trajectories are under development within Australia and internationally or secured behind paywalls and therefore excluded from this analysis.

Connecticut Early Learning and Development Standards

These trajectories cover ages from birth to 5 years, across 8 domains: cognition; socio-emotional learning; physical development; language and literacy; creative arts; math; science; and social studies. A 'bonus' progression is provided for second language acquisition. The trajectories include suggestions for spontaneous and planned experiences to support each domain. They also have a 'family input' aspect, where information about children's learning and development is collected through engagement with families.

North Carolina Early Learning and Development Progressions: Birth to 5

These progressions cover 4 domains: emotional and social development, health and physical development, language and communication, and cognitive development. The birth to 5 years age range is divided into 18 segments, each covering 2 to 6 months. Skills are identified within each domain at each time point, which reflect progress along a 'skill progression' towards a 'goal' (e.g., 'scans internal details' is a step along the 'classifying' progression, towards the goal 'children compare, sort, group, organize and measure objects and create patterns in

their everyday environment'). For each skill, the progression identifies situations where the skill could be observed, any elicitation strategy that could be needed, what the behaviour would look like, and what embedded instructional strategy could be used to extend the skill.

Early Learning and Development Standards for children from birth to 7 years

These are a set of learning trajectories developed by UNICEF describing progress from 0 to 7, in 5 domains: 'physical development, health, and personal care and hygiene', 'socio-emotional development', 'approaches to learning', 'development of language, communication and the premises of reading and writing', and 'cognitive development, world knowledge and understanding' (Anghelescu et al., 2010). Each domain comprises a number of subdomains, each with their own 'specific aspects.' Development within each specific aspect is divided into 4 age groups (from birth to 18, 19 to 36, 37 to 60 and 61 to 84 months), with a variety of indicators and supportive practices highlighted for each step.

Other resources

Targeted learning trajectories also exist for specific domains. Mathematics is the domain for which the most trajectories have been developed. Examples include:

- Learning Trajectories: Early Math – Birth to Grade 3, developed by leading researchers with support from the US Government for children from birth to 8 years of age.
- SPLAT-maths and the Early Learning STEM Australia (ELSA) project are developing 'bounded learning progressions' for spatial and logical reasoning for children from 4 to 7 years of age based on children's use of play-based learning apps.

Many learning trajectories or progressions also exist for use in schools. These are often linked closely to curriculum documents for the relevant domain. For example:

- National Literacy and Numeracy Learning Progressions for Australian schools are aligned with relevant areas of the Australian Curriculum.
- K–12 Reading and Writing Learning Progression Frameworks and K–12 Math Progressions are detailed progressions linked to the US Common Core State Standards, with the mathematics domain alone containing 16 draft progressions.
- New Zealand Learning Progression Frameworks cover reading, writing, and mathematics from school entry to year 10, and are heavily integrated with school curriculum. Each step has 'illustrations' of how students could show evidence of the indicator. They were developed by the Ministry for Education for use with the Progress and Consistency Tool (PaCT) student observation and tracking system.

Learning trajectories also exist for specific cohorts of children in the school years. For example, trajectories of Standard English language development focused on children with English as an additional language or dialect (EAL/D) have been created as a resource for teachers across Australia as well as more specifically for those in the Northern Territory and Western Australia.

Insights from teachers, educators and leaders

Consultation with teachers, educators and leaders from diverse ECEC services also informed the development of the learning trajectories. This occurred in 2 ways:

- AERO convened a national Panel of Teachers, Educators and Leaders to review prototype learning trajectories and discuss how they could be used. Panel members came from long day care, preschool and family day care, and from most states and territories. The panel provided feedback in writing and in a major workshop.
- Expert researchers (in partnership with the VCAA) undertook field trials of initial prototypes of 3 learning trajectories with 22 Victorian teachers and educators. Participants in the 4-week trial worked in long day care, preschool and outside school hours care, with qualifications ranging from diplomas to master degrees. Most worked with children aged 3 to 4. Participants shared their feedback through a focus group or in writing. No family day care services opted to participate in the trial.

Insights from teachers, educators and leaders were supplemented by consultation with a Project Advisory Group comprising ECEC sector leaders and policymakers. This ensured that the learning trajectories addressed priorities in both policy and practice.

Insights from teachers, educators and leaders are summarised below.[1] A strong theme was that the trajectories must align with the EYLF (or VEYLDF), to enhance practices already in use. For this reason, insights are organised under the most relevant EYLF V2.0 principles and practices, to show how the trajectories support EYLF V2.0 implementation.

In general, teachers, educators and leaders saw the trajectories as an ongoing learning opportunity that could have significant impact on ECEC practice in Australia. This optimism not only reflected the usefulness of the trajectories for practice, it also reflected their potential to give greater visibility to the learning that occurs in ECEC services from the earliest years, and the importance of teachers' and educators' work.

> 'I think if people can get their head around it, and be supported and understand it, I think it's extremely valuable, not only for educators, but for our families and for the [sector] as a whole.'
>
> (Field trial participant)

Practice: Assessment and evaluation for learning, development and wellbeing

Teachers, educators and leaders agreed that the learning trajectories were most useful for improving assessment practice – a priority in many services' Quality Improvement Plans. Language and ideas from the trajectories could assist in making or interpreting observations and helping to make children's learning and development more visible. The trajectories were also seen to promote deeper understanding of the broad, integrated EYLF learning outcomes, enabling learning to be described with greater specificity.

> 'The observations were more purposeful, using the learning trajectories we had. Your observations will become more meaningful because you'll be looking for those things rather than just doing observations that were there and then linking them [to the EYLF].'
>
> (Field trial participant)

1 These insights were selected for their relevance to the final version of the learning trajectories. Many comments were received on earlier versions that informed the trajectories' iteration and refinement.

Practice: Play-based learning and intentionality

More purposeful observations can lead to greater intentionality in planning play-based learning experiences. The trajectories were seen as challenging teachers and educators to look for patterns or gaps in children's learning and development across the domains, and to use these to inform next steps in curriculum and pedagogical decision-making.

> 'Language from the trajectories also inspired learning provocations, moving forward, where you're saying what is the next step. So, it was good in thinking about what comes next.'
>
> (Field trial participant)

Practice: Continuity of learning and transitions

The continua of learning described in the trajectories was seen as especially beneficial in supporting smooth transitions and continuity. This was most evident in supporting communication across rooms with different age groups and enabling each teacher and educator to see how children's progress in their room connected to others. The possibility was also often raised of using the trajectories to communicate with primary school teachers, to complement existing resources such as transition statements.

> 'It is beneficial for us as a team when the children move from 3-year-old to 4-year-old groups. So, it is a really good tool that can be passed from educator to educator.'
>
> (Field trial participant)

Principle: Critical reflection and ongoing professional learning

All stakeholders agreed that using the trajectories would involve an ongoing process of critical reflection and professional learning, either for individuals or across teams. Many suggested engaging with one trajectory at a time, or even one subdomain or strand. As one educator commented: 'We can change the world, one trajectory at a time'.

Another important consideration was balancing professional pedagogical terminology with language that would be accessible to educators at all qualification levels. Overall, the trajectories were seen as accessible enough to be used by all educators, although some vocabulary may be unfamiliar at first. Some stakeholders noted that further support might be beneficial for educators from culturally and linguistically diverse communities.

While most field trial participants used the trajectories for individual professional learning, the potential for rich collegial professional learning was also evident. Some field trial participants reported robust discussions about the trajectories, which helped both to affirm existing effective practices and to enable teachers and educators to challenge and extend each other's thinking. Many panel members were educational leaders at their services, and saw great potential for ongoing collegial learning. This flowed through to potential for more collaborative practice, as teachers and educators adopted common understandings and shared language about children's learning.

> 'As a team we really enjoyed it, and it was a positive experience. We had a lot of robust conversations around what we thought and also differing opinions – it was valuable.'
>
> (Field trial participant)

Principle: Respect for diversity

Teachers, educators and leaders appreciated how the learning trajectories allowed them to see that children's learning is individual and develops over time. They also valued the strengths-based approach evident in the language used in the trajectories, and how this supports positive observations and analysis of children's learning. This can also help inform differentiated teaching that responds to the unique capabilities of each child.

Some field trial participants initially mistook the trajectories for a checklist or expected that they would adopt an ages-and-stages approach. While some participants noted the usefulness of age-based tools for some purposes, most appreciated the way that the trajectories encourage a focus on learning as a continuum, not as discrete steps.

Principle: Partnerships

As well as collaborative practice within services, the learning trajectories were seen as supporting partnerships with families. Because they are not age-based, they were seen as more likely to be well-received by families interested in their child's individual progress. The accessible language was also seen as valuable for communicating with families, and the opportunities to support children's learning and development at the end of each subdomain were seen as useful tips to pass on to families too.

> 'We do interviews with families twice a year so this would be really valuable to be able to show the families this kind of document.'
>
> (Field trial participant)

Looking ahead

These insights affirm the value of the learning trajectories for building knowledge among teachers, educators and leaders, and thereby improving outcomes for children. They also highlight the need for ongoing experimentation and discussion about how the trajectories can best be used, and what support and additional resources may be required. AERO will continue this process as the trajectories are implemented in 2023.

Inevitably, consultations also highlighted the challenges that Australian ECEC services currently face, arising from workforce pressures and policy reforms. It was important to all stakeholders that services are encouraged – not required – to explore the trajectories at their own pace and use them in a way that aligns with their current priorities. In this way, the trajectories can provide a welcome chance to refocus on what matters most for all teachers and educators: the difference that they make to children's learning.

Insights from the science of learning and development

Each learning trajectory summarises an extensive body of research on how children learn and develop. Where possible, the names of subdomains within the trajectories reflect established concepts in the research that may already be familiar to teachers and educators; but, in many cases, designing the subdomains, strands and indicators involved a careful process of synthesising many different research perspectives.

The EYLF (DEEWR, 2009), EYLF V2.0 (AGDE, 2022) and the VEYLDF (DET & VCAA, 2016) guided decisions about how to engage with the research. The EYLF and EYLF V2.0 also draw on a strong research base, and evidence-based insights about each domain appear throughout the framework. The trajectories describe each domain in a way that aligns with these insights, to deepen teachers' and educators' understanding.

Key insights about each domain from the EYLF V2.0 and evidence base are outlined below. Rather than providing a comprehensive summary of available research, these insights highlight important aspects of each domain that the learning trajectories can help teachers and educators to understand. These insights can serve as provocations for professional learning, both to affirm existing knowledge and to introduce new perspectives.

Although insights are presented under each domain, a strong theme in both the research and the EYLF V2.0 is that learning and development is connected across all domains. The first 2,000 days (5 years) are a critical period for physical, cognitive, social and emotional development in the life of a child, and experiences during this period shape neuronal connections in young children's brains (Shonkoff, 2003).

Learning often occurs in reciprocal ways, with progress in one domain building on progress in another, while also enabling further progress in other domains. Connections that were especially visible in the research are discussed under each domain. However, all domains reinforce and reflect each other to some extent, as well as contributing to the holistic learning outcomes in the EYLF V2.0 (see early childhood learning trajectories user guide).

Executive functions

Executive functions are a group of complementary skills that influence each other (Diamond, 2016). Leading research on executive functions identifies 3 components: working memory, inhibitory control, and cognitive flexibility (Garon et al., 2008; Wiebe et al., 2011). These components are sometimes called 'updating' (managing what is stored in working memory), 'inhibition' (suppressing unwanted actions) and 'shifting' (mentally switching tasks) (Miyake et al., 2000, p. 49). Goal setting is sometimes identified as a fourth component (Anderson, 2002; Stuss & Alexander, 2000).

The components of executive functions all support one another. For example, working memory enables a child to remember the sequence of steps involved in a task; inhibitory control enables them to stay focused on the task; and cognitive flexibility enables them to shift between steps that require different thought processes. Much of the research on early executive function has investigated relationships between these components, and how they emerge and can be supported across the early years. Key insights from the research that guided the development of the learning trajectory are outlined below, along with connections to the EYLF V2.0.

Executive functions enable success in learning and in everyday life

The EYLF V2.0 links executive functions to skills required for learning and everyday activities, including planning, focusing, remembering instructions and managing multiple tasks.

Executive functions are crucial for learning and life. Working memory enables the brain to hold onto and use new information. Inhibitory control involves taking thoughtful, planned actions rather than responding as if on 'autopilot'. Cognitive flexibility enables children to switch perspectives, refocus attention and experiment mentally with ideas (Diamond, 2013). This combination is often described as an 'air traffic control' system for the brain (Center on the Developing Child at Harvard University, 2011, p. 1).

These abilities are thought to explain why children with higher executive functions also achieve better results in literacy and mathematics (Bierman & Torres, 2016; Blair & Razza, 2007; Bull et al., 2008; McClelland et al., 2007). Research suggests that early executive functions are stronger predictors of children's academic attainment at school than IQ (Alloway & Alloway, 2010; Blair, 2002). The link between executive functions and academic outcomes remains significant from preschool to university age, even when controlling for initial achievement and cognitive ability (Diamond, 2016). Conversely, children with less developed executive functions in early childhood tend to fall further behind their peers over time (Diamond, 2016; Pellicano et al., 2017).

Executive functions are not just related to learning. They have been shown to predict resilience to early adversity (Bierman & Torres, 2016), as well as various other outcomes over the life course. A longitudinal study of 1,000 participants found that early executive functions predicted quality of life indicators at age 32, such as physical health, socioeconomic status, educational attainment and income level (Moffit et al., 2011).

Executive functions are closely related to self-regulation and behaviour

The EYLF V2.0 associates executive functions with self-regulation, managing emotions and perseverance. It recognises the impact of cognitive development on behaviour.

As a set of cognitive capacities, executive functions form the foundation of self-regulation alongside other higher-order skills such as planning, problem-solving and organisation (Miyake & Friedman, 2012). The terms 'executive functions' and 'self-regulation' are sometimes used interchangeably, although researchers argue that the 2 concepts are distinct (Cumming et al., 2020). While executive functions are the cognitive processes required for self-regulation, that is not their only use. For example, solving a maths problem requires executive functions, but does not involve the change in emotion, thought or action involved in self-regulation (Nigg, 2017).

Executive functions depend on healthy early brain development

The EYLF V2.0 acknowledges the link between executive functions and brain development, affirming that executive functions reflect higher order cognitive functioning processes.

Executive functions are closely related to brain development, and require maturation of the brain's prefrontal cortex (Anderson et al., 2020). The developmental trajectory of executive functions therefore depends on the prefrontal cortex's maturation from infancy through to late adolescence (Diamond, 2002). The early building blocks of executive functions, including control of attention, begin to emerge due to the significant increase in metabolic rates and neuron connections within the prefrontal cortex in the first few years of life (Carlson, 2003; Cuevas et al., 2017).

Evidence of executive functions becomes apparent during the first year of life, as infants start to sustain, shift, and inhibit their attention in progressively sophisticated ways. Research has explored early brain development related to executive functions using specific psychological tests, such as infants retrieving a hidden toy after a short delay (Diamond & Doar, 1989); or toddlers imitating an adult sorting objects (Miller & Marcovitch, 2015). Research identified a further critical period in the development of executive functions, commencing at around 3 years of age. This is marked by improvement in the attention system and increased connectivity with other brain regions (Garon et al., 2008).

Executive functions also depend on a stimulating, nurturing environment

The EYLF V2.0 shows how familiar routines help children develop their independence and agency, while novel or challenging environments promote flexibility and perseverance.

While executive functions are partially shaped by genetic factors (Miyake & Friedman, 2012), they also depend upon the creation of a stimulating environment for the child. This is mainly because the maturation of the prefrontal cortex of the brain is susceptible to environmental influences (Choi et al., 2016). Research confirms the important role that quality experiences in ECEC services can play in nurturing healthy brain development and improving children's executive functions (Diamond, 2013).

Fostering executive functions in ECEC involves challenging children to extend their thinking, planning and problem-solving skills, while providing just enough support to enable them to build their independence. Research identifies high-quality adult-child interactions, plenty of opportunities for socio-dramatic play, and responsive classroom environments as factors that can improve executive functions in children (Bierman & Torres, 2016).

Research has also explored the role of digital technology in supporting or inhibiting the development of executive functions in children (Hardy, 2017). Recent findings emphasise the importance of social interactions in mediating children's use of digital technologies and fostering their sense of agency (Nolan et al., 2022).

Social and emotional learning

Social and emotional learning has been defined in many ways in research (Halberstadt et al., 2001). A widely used definition of social and emotional learning comes from the Collaborative for Academic, Social and Emotional Learning (CASEL):

> The process by which children and adults acquire the knowledge, attitudes and skills to recognise and manage their emotions, set and achieve positive goals, demonstrate caring and concern for others, establish and maintain positive relationships, make responsible decisions and handle inter-personal situations effectively (CASEL, n.d.).

This definition shows that social and emotional learning is a broad, complex domain. A simpler definition appears in the 'Personal and social capability' strand of the Australian Curriculum (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2017) comprising 4 components: self-awareness, self-management, social awareness, and social management. AERO's learning trajectory also uses this structure. Additional insights from the research that guided the development of the learning trajectory are outlined below, along with connections to the EYLF V2.0.

Social and emotional learning involves learning about the self and others

The EYLF V2.0 recognises that children develop awareness of many aspects of their own identity alongside the understandings they need for interacting with others.

Young children undergo rapid social and emotional development, starting from birth. As their social interactions increase, children develop awareness of others and gradually learn to differentiate their own needs from those of others (Thompson et al., 2006). From a very young age, children can attune to the mental states of other people and come to develop a 'theory of mind': an understanding that other's beliefs and desires may differ from their own (Thompson et al., 2006). They also learn to effectively identify and manage their own emotions, and to build and maintain positive relationships with others (Australian Children's Education & Care Authority [ACECQA], 2020, 2022; Frydenberg et al., 2020).

Social and emotional learning includes both knowledge and behaviours

The EYLF V.20 includes knowledge related to social development, such as naming emotions or understanding rules, as well as social behaviours such as listening and collaboration.

Social and emotional learning involves a child understanding about social and emotional behaviours as well as enacting those behaviours (McKown, 2015). While all the theories of social and emotional learning recognise that comprehension and execution (*knowing* and *doing*) are closely related, some children have the former skills but not the latter (McKown, 2015). Different approaches are therefore needed to assess children's social and emotional knowledge and behaviours (Elliott et al., 2015).

Teachers and educators in ECEC services can support the acquisition of both knowledge and behaviours. In addition to clear instruction to scaffold understanding, teachers and educators (along with families and peers) can model positive behaviours. The way adults identify and regulate their own emotions and model healthy coping and prosocial skills has an impact on young children's social and emotional learning. This includes their ability to self-regulate and to build and maintain positive relationships (Bierman & Motamedi, 2015; Frydenberg et al., 2021). Participation in ECEC is recognised as an important strategy for fostering social and emotional learning for all children. This participation sits alongside targeted programs for children and families, or multi-faceted programs that involve other services such as child and family support (Mondi et al., 2021).

Social and emotional learning supports wellbeing and other forms of learning

The EYLF V2.0 shows how care, empathy and respect enable children to participate in shared play-based learning, and to support wellbeing for themselves and others.

Social and emotional learning is a key contributor to personal competence and benefits mental health and learning outcomes. Research has linked social and emotional learning interventions in preschool to significant improvement in social competence, emotional competence, behavioural self-regulation, and early learning skills, as well as reduced behavioural and emotional challenges (Blewitt et al., 2018). Recent research shows potential benefits of early social and emotional learning interventions for children with mental health issues and developmental delays (Blewitt et al., 2021). Research on social and emotional learning in schools shows that benefits to achievement and other outcomes can persist into high school (Durlak et al., 2011).

Social and emotional learning reflects the aims of contemporary education, to prepare children and young people to be caring, responsible, and productive members of society (Waters & White, 2015). Social and emotional competencies gained in the early years provide the foundations for strong relationships, positive emotions, personal resilience, mindfulness, and a healthy lifestyle (Frydenberg et al., 2020). Social and emotional learning is therefore key to preparing children for a successful, healthy life.

Social and emotional learning involves cognitive growth as well as interactions

The EYLF V2.0 recognises that caring relationships are crucial to healthy brain development, and that skills such as self-regulation depend on higher-order cognitive processes.

Social and emotional competencies are usually seen as developing through everyday learning (Denham, Bassett, Mincic et al., 2012; Denham, Bassett, & Zinsser, 2012). Complex neurological processes lie behind these everyday experiences, demonstrating the link between brain development and social and emotional learning. Brain development is not passive, but an active and interactive process that occurs within the context of family, community and society. Children's brain development is more vulnerable to environmental influence during the first 5 years of life (O'Shea, 2005). Early life experiences can exert a profound influence on the brain architecture and behavioural development. Enriched social, emotional and learning environments in the early years foster healthy brain development and can assist children to overcome the effects of early adversity (Fox et al., 2010).

The effects of social and emotional aspects of the environment on brain development begin in the perinatal period. Factors most proximal to the infant, such as caregiving responsiveness, maternal mental health, couple relationship, and socio-economic status are strongly associated with infant social and emotional status by 18 months (McIntosh et al., 2021). From approximately 3 to 7 years of age, sizeable growth occurs in the prefrontal cortex of the brain (Diamond, 2002), which is associated with higher order skills such as empathy. The prefrontal cortex also interconnects with deeper neural structures including the fear-response centre of the brain, the amygdala, which is required for perspective-taking and moral decision-making (Decety et al., 2015). This area of the brain is also used in self-regulation, with relevant skills in affect regulation (that is, recognising, understanding, labeling, expressing and regulating emotions) developing across childhood and maturing during adolescence (Brackett, 2019; Brackett et al., 2012; Macklem, 2008).

Mathematical thinking

Mathematical skills in early childhood refer to number and quantitative thinking, geometry and spatial thinking, geometric measurement, patterns and algebraic thinking, data analysis and mathematical processes (Clements & Sarama, 2007). Numeracy is the application of mathematical knowledge, defined in the EYLF V2.0 as 'the capacity, confidence and disposition to use mathematics in daily life' (AGDE, 2022, p. 57).

Much research on early mathematical thinking has focused on number knowledge, and on children 3 to 8 years of age. Some evidence addresses other aspects of mathematical thinking, including for younger children. Key insights that guided the development of the learning trajectory are outlined below, along with connections to the EYLF V2.0.

The foundations of mathematical thinking emerge in infancy

The EYLF V2.0 recognises the early stages of mathematical thinking, such as when children explore using their emerging spatial sense or develop patterns in their movement.

Young children begin exploring mathematical concepts long before starting formal schooling (Perry & Dockett, 2005), beginning in infancy (MacDonald & Murphy, 2021). For example, infants can recognise differences in set sizes (Starr et al., 2013), while toddlers investigate spatial concepts and attributes of shapes (Franzén, 2021) and a range of other mathematical concepts (Björklund, 2008). Various studies have explored the order in which mathematical concepts emerge in early childhood. One example of this is Van den Heuvel-Panhuizen and Elia (2020) who created a model for how quantification and quantitative reasoning emerges, following the trajectory of sequential steps of counting, subitising (being able to recognise how many items are in a small set without counting them), additive reasoning then multiplicative reasoning.

Because mathematical ideas build on each other, mathematical learning is cumulative, and children who have stronger foundational knowledge can learn later concepts more easily (Jordan et al., 2010). Growth in children's mathematics ability between 54 months of age and early primary school strongly predicts mathematics achievement at age 15 (Watts et al., 2014). Children's progress in mathematical thinking can be supported when they have opportunities to represent mathematical knowledge in meaningful ways. This has been demonstrated in Australian studies on patterns and structural relationships (Mulligan et al., 2020), measurement skills (MacDonald & Lowrie, 2011) and spatial thinking skills (Cohrssen & Pearn, 2019).

Mathematical thinking is embedded throughout everyday play and routines

The EYLF V2.0 encourages close connections between mathematical ideas and children's everyday experiences, including using culturally relevant materials to explore ideas.

Children are surrounded by opportunities for mathematical thinking, which teachers and educators can support (Knaus, 2013). Applying mathematical concepts to real-world situations helps children understand the mathematics that is occurring (Clements & Sarama, 2021; Rosales, 2015). When teachers and educators understand how mathematical thinking develops, they can provide richer learning opportunities (Clements & Sarama, 2021), using a balance of adult-led and child-led play-based experiences (Pascal et al., 2019). Play is an important pedagogical tool for teaching mathematics in the early years (Reikerås, 2020), provided it is guided by a clear aim and shared understanding of the mathematics within the experience (Vogler, 2019).

Children can use mathematical thinking in play and routines in many different ways:

- Children apply knowledge about number and counting when they describe shapes (a triangle has 3 sides), measure how long their train track is (12 blocks long) or use data to work out who has the most blueberries (10, 12 or 22).
- Children demonstrate spatial thinking when they navigate their environment, understanding where objects are in relation to themselves and to other objects.
- When children build pictures with shape tiles, they are exploring how shapes can be constructed and deconstructed. This concept underpins arithmetic too: quantities can be constructed and deconstructed in various ways.

- Children may notice patterns in their environment, including repeating patterns, patterns that represent a quantity (dots on a domino) or spatial patterns (similar shapes). Patterns can be auditory and gestural (clapping games at group time).
- Sorting tasks, such as putting socks in pairs, can encourage children to pay attention to attributes of objects (shape, orientation, pattern), and their quantity and number (tag each sock with one number word or even skip count in 2s).

Language development is important for supporting mathematical thinking

The EYLF V2.0 encourages the use of a rich vocabulary to support mathematical thinking, including counting out loud or discussing mathematical concepts and arguments.

The ability to use words, or vocabulary, is necessary to the overall development of mathematical proficiency: indeed, a child's general knowledge of mathematical vocabulary predicts mathematical performance (Riccomini et al., 2015). Language also helps foster higher order thinking as children reason, explain, justify, and reflect. Gestures can also be part of mathematical communication. For example, appropriate use of fingers can support children's number sense, especially ordinality (sequence of numbers) and cardinality (number of items in a set) (Baccaglini-Frank et al., 2020).

Acquiring mathematical knowledge and the associated vocabulary equips children to recognise and understand the role of mathematics in the world, apply it in everyday life, and communicate their thinking. Evidence of emerging mathematical knowledge includes children using counting words, recognising and copying patterns, recognising and naming shapes, using language of location and direction, comparing attributes of objects such as length and height, and using measurement-related language. When teachers and educators follow a child's lead during play and engage in back-and-forth conversations, they can extend mathematical thinking, support learning about mathematical concepts and encourage mathematical language (Cohrssen, 2022).

Mathematical thinking underpins important skills for life and learning

The EYLF V2.0 recognises that mathematical thinking involves more than counting, and includes skills such as navigating spaces, connecting ideas and making predictions.

There is a strong correlation between mathematics, language, and executive functions. Executive functions support the goal-directed problem solving and critical thinking required in mathematics reasoning, which contributes to science, technology, engineering and mathematics (STEM) learning (Rosicka, 2016). STEM is recognised as important for life and learning, as it enables children to link to everyday learning to more abstract concepts (Knaus & Roberts, 2017). It fosters general capabilities including critical thinking, problem-solving skills, creativity, information and media literacy, communication, collaboration and self-directed learning.

The connections between mathematical thinking and other outcomes are evident across the life course. Early mathematical skills not only predict later mathematics achievement (Aubrey et al., 2006; Aunio & Niemivirta, 2010; Clements & Sarama, 2021), but also reading (Duncan et al, 2007; Duncan & Magnussen, 2011). A large-scale study found mathematics ability at age 7 predicted a range of outcomes in adulthood, including intelligence, years of education and socio-economic status at age 42 (Ritchie & Bates, 2013). It is internationally recognised that mathematics helps all children and young people to become 'constructive, engaged, and reflective citizens' (Organisation for Economic Co-operation and Development [OECD], 2013, p. 170).
This means that access to mathematics teaching and learning in early childhood is an important part of recognising and supporting children's rights (Cohrssen & Page, 2016).

Language and communication

The domain of language and communication is defined in research as follows:

- **Communication** refers to an exchange of meaning.
- **Language** (oral or written) is the main form of communication, expressing meaning and connecting with others. Communication can also be non-verbal, including gestures, signs or signed languages, posture, facial expressions, and movement.

Literacy is often used to refer to increasing competency in reading and writing. The EYLF V2.0 takes a broader view of literacy as 'the capacity, confidence and disposition to use language in all its forms through written, oral, visual and auditory' (AGDE, 2022, p. 57).

Research on early language and communication comes from a range of disciplines, including early childhood education, psychology, sociology, child development and second language acquisition. Insights from the research that guided the development of the learning trajectory are outlined below, along with connections to the EYLF V2.0.

Language and communication begin in infancy

The EYLF V2.0 recognises that children communicate from birth, by using gestures, sounds and eye contact, and by engaging other children or adults in joint attention.

Communication in infancy begins with non-verbal interactions created through physical movements of the body, such as crying and, later, gestures (Cartmill et al., 2012). Gestures may indicate a child wants something or to share something such as attention, emotion, and information (Cochet & Vauclair, 2010; Murillo & Capilla, 2016). Infants can use gestures such as shifting eye gaze, pointing or making eye contact to engage the person with whom they are communicating in joint attention, focusing on a place, object or person of interest (Airenti, 2017; Behne et al., 2012; Salo et al., 2018).

Infants also take 'talk turns' when babbling or cooing and imitate the rhythm and intonation of adults. These early communicative practices are common across cultures (Liszkowski et al., 2012) and provide a vital link between pre-verbal and verbal communication (Airenti, 2017). As infants move into the toddler stage, they may use a consistent speech sound to name objects in their world – for example, '*nana*' for 'ball' – before using the conventional language for naming (Owens, 2020).

Oral language is the foundation for reading and writing

The EYLF V2.0 recognises that the ability to connect words, sounds and symbols to their meanings is the foundation for both oral and written language and communication.

Oral language development is the foundation for emergent reading and writing (Tracey & Morrow, 2017), as children gain familiarity with the sounds, vocabulary and grammatical constructs of their first and subsequent languages. As toddlers begin to use language, they learn to use single words, followed by rapid vocabulary development (Noro & Mota, 2019). Next, they use simple speech acts, which are 2 or more words that follow some grammatical pattern. The length of utterances and use of grammatical patterns continue to grow as toddlers move through childhood.

A key part of language development is symbolic understanding, or understanding that objects can represent many things, including make-believe things. For example, a banana or a hand can be a phone. This is a foundational skill for literacy development (Neuman & Celano, 2018; Raban, 2022), as children also learn that writing represents meaning.

This understanding enables children's writing to progress, from making marks, scribbling and drawing in infancy (Raban, 2020); to making marks that resemble letters (beginning with random letters or letters in their names); to using letters to convey meaning. The ability to write words, phrases and sentences grows as children develop their oral language and understanding of how language works.

A high quantity and quality of language input is important for fostering oral language development throughout the early years (Hoff, 2006). Studies have consistently shown the positive effect that rich input from adults can have on children's vocabulary and grammar (Hart & Risley, 1995; Torr, 2018; Walker & Carta, 2020). Examples of quality language input include sustained shared conversations (see AERO resource), shared book reading (Wasik et al., 2016), reciting rhymes (Raban, 2020), telling stories (Pesco & Gagne, 2017), using decontextualised language (language that does not involve the here and now, such as recalling a previous event), and singing songs.

Language is linked to cognitive, physical, social and cultural development

The EYLF V2.0 makes many connections between language and communication skills and other diverse areas of learning, such as numeracy, social skills and cultural identity.

Many studies have shown how early language and communication skills are linked to later literacy outcomes (Ouellette & Sénéchal, 2017; Sénéchal, 2017; Treiman et al., 2019). Early language skills also relate to other primary school curriculum areas, such as numeracy (Birgisdottir et al., 2020). The effects of delayed or impaired language development on subsequent learning outcomes are still evident in later years of schooling; at age 16; and even at age 25 (Psyridou et al., 2018; Johnson et al., 2010).

Children's language development is also linked to their socio-emotional development. Research shows that children who have poor early communication skills are at a greater risk for later socio-emotional behavioural problems (Airenti, 2017; Heberle et al., 2020; Rautakoski et al., 2021). Additionally, children's language and literacy competencies impact upon their self-concept, particularly as they enter formal schooling. A recent study involving children in their first year of schooling (Walgermo et al., 2018) highlighted the relationship between reading ability and self-concept and demonstrated that this relationship further affected children's reading development.

Learning language involves understanding both its structure and use

The EYLF V2.0 includes key literacy concepts such as letter-sound relationships, as well as the use and enjoyment of language and communication in a range of contexts.

Children's emerging understanding of language includes phonological awareness (for example, rhyming, recognising letters in words, identifying syllables, blending and segmenting sounds in words), phonics (matching sounds with letters), vocabulary, fluency and comprehension (Catts, 2018; National Institute of Child Health and Human Development [NICHD], 2000; Rowe & National Inquiry into the Teaching of Literacy [Australia] 2005). This complex body of knowledge includes the structures of language, as well as how language is used for a wide range of both expressive (transmitting) and receptive (receiving) purposes.

Teachers, educators and families have an important role to play in fostering children's understanding of how language is used, as well as structural elements like sounds, letters and words. The many uses of language can be modelled by establishing print rich environments, reading and talking about different texts and their purposes, engaging children with print, modelling writing, providing opportunities for drawing and writing, supporting home language, and using literacy in real-life contexts. Adults can model new vocabulary and grammatical structures in interactions with children, as well as demonstrating the ways in which language is used in social situations.

Recent research has shown the importance of hearing language in different contexts (Goldenberg et al., 2022). For example, children may learn new words in shared story sessions, then use that vocabulary in guided play. They may then draw or talk about their experiences over several days, re-using the vocabulary in different situations.

Children use diverse languages and methods of communication

The EYLF V2.0 recognises the importance of children's first languages, as well as the many forms that communication may take, including through art and digital technologies.

Many Australian children first learn to communicate in a language other than English. Continued nurturing of children's home languages alongside English is important for maintaining cultural ties and transmitting cultural ways of being and knowing (Eisenchlas et al., 2013; MacLeod et al., 2014; Tseng, 2020). Bilingual children learning 2 languages at once may initially seem to lag behind their monolingual peers, but can achieve similar levels of competency to monolinguals in both languages over time (De Houwer, 2021; Gathercole, 2018). The diverse linguistic and cultural experiences that occur in children's homes equip all children with rich funds of knowledge, which teachers and educators can nurture and draw upon to support language development (Comber, 2016; Eisenchlas et al., 2013; Gonzalez et al., 2005; Krakouer, 2016; Moll, 2019).

For young children today, communication is multimodal and can include the use of pictures and videos, songs, rhymes and music, dance, voice, symbols and scripts (Fellowes & Oakley, 2020). Young children should be supported to develop the fine and gross motor skills that enable use of different communication methods, and to experience playing with different writing tools, including digital and multimodal tools (McFarland, 2018). Play is also important for helping children explore and express their ideas in different ways and build their skills and understanding.

Physical development

Physical development refers to a child's advancing ability to move and control their body. It is closely related to general physical health, as low levels of physical activity and poor motor skill proficiency in early childhood are directly related to adverse health outcomes (Jones et al., 2016). It also supports all other learning and development.

Multiple perspectives exist on what constitutes typical physical development, but most agree that physical development occurs along a trajectory, and certain behaviours precede others (O'Connor & Daly, 2016). The foundations of movement are laid in infancy and there is a general age range in which types of movement are typically expected to emerge (Case-Smith, 2015). Motor and sensory regions develop first, followed by refinement of control and integration of these (Casey et al., 2005; Veldman et al., 2019). Typically, motor skill development occurs from proximal to distal, that is, from the top down and from the centre outwards (Case-Smith, 2015; O'Connor & Daly, 2016).

Various theories show how physical development involves a complex interplay of biological factors and experiences (Case-Smith, 2015). According to dynamic systems theory, movement and its control results from interaction between various body systems, including cognitive, neurological, muscular and skeletal systems (Veldman et al., 2019). Development also depends on the interaction between genetic factors, environmental factors and an individual's role in their own development (Bell et al., 2020; Case-Smith, 2015). Key insights from research that guided the development of the learning trajectory are outlined below, along with connections to the EYLF V2.0.

Physical development includes acquiring specific skills and coordinating them

The EYLF V2.0 recognises that physical development involves fundamental movement skills as well as connections between children's sensory, physical and motor systems.

As children grow, a significant component of their physical development is motor development. Motor development is divided into gross and fine motor skills:

- Gross motor skills involve large movements and large muscles such as those in the hips, shoulders, arms, legs, and torso. Gross motor skills include locomotor skills (movement that allows travel, such as walking, running, skipping and jumping); object manipulation (movement that controls objects, such as throwing, catching, lifting and kicking); and balance (movement that creates stability, such as twisting, bending, stretching and turning) (Duncombe, 2019; Veldman et al., 2019).
- Fine motor skills involve smaller movements and the small muscles in the forearms, hands and wrists. Combined with cognitive processes, they enable tasks such as buttoning, drawing, and using a spoon (Arnett et al., 2018; Case-Smith, 2015; Soan, 2020).

Typically, between 2 and 6 years, children build the basic gross and fine motor skills needed for simple everyday tasks, such as putting on clothes and fastening buttons and zips (Case-Smith, 2015; Duncombe, 2019). Tying shoelaces and other more complex skills typically emerge toward the end of this period, while handwriting is not fully developed until around 10 years of age for a typically developing child (Soan, 2020).

Physical development involves more than just skills, and includes the brain, muscles, bones and all senses, including body awareness and balance (Veldman et al., 2019).

Motor skills are supported by other body functions such as sensory processing, muscle strength, postural control, balance, motor coordination and motor planning (Case-Smith, 2015; Duncombe, 2019; Veldman et al., 2019). Many fine motor skills also depend on visual motor control, bilateral hand use, and cognition (Arnett et al., 2018; Case-Smith, 2015; Soan, 2020). Neuromaturational theory recognises that motor development is enabled as the central nervous system matures (Roeber et al., 2014).

Physical development occurs continuously, not just at milestones

The EYLF V2.0 identifies developmental milestones as potentially useful in summative assessment, but encourages attention to each child's unique developmental path.

Physical development progresses toward greater complexity via a gradual, continuous process, with periods of rapid growth followed by stable periods when little change occurs (Mulligan, 2014). Teachers and educators can support this gradual process by noticing how physical development can be fostered in everyday experiences. Learning through experience is a key aspect of physical development and begins with exploration of the environment (Duncombe, 2019; Shonkoff, 2003). Encountering a variety of surfaces, textures and objects allows children to develop sensory pathways between body and brain (O'Connor & Daly, 2016), building mobility and manipulation.

Physical skills develop with practice, and children learn by using trial and error and problem solving over time, until the target skill becomes easy and automatic (Case-Smith, 2015; Soan, 2021). Children use feedback and reinforcement to adjust their performance as they repeat movements multiple times, until muscle memory develops and they reach skill achievement (O'Connor & Daly, 2016). This makes it important for children to have opportunities to learn and practice movement skills to achieve competency (Duncombe, 2019). Learning a new motor skill also requires a child to be motivated and to know what the skill requires (Soan, 2021). Teachers and educators can support this process both by explicitly teaching new skills and by encouraging children to practice and experiment with their bodies in their play.

Children's physical development can be supported even before gross and fine motor control emerges. The early years are when habits of posture emerge in response to challenges to balance and position, along with the forces of gravity (Soan, 2021). Playing and actively moving in the earliest years of life help young children develop balance and stability, body awareness and posture (Soan, 2021). Progress in these areas in infancy lays the foundations for the major physical milestones that occur later.

Physical development is influenced by context, culture and environment

The EYLF V2.0 encourages physical activities that reflect family and community experiences, while recognising that different perspectives can impact preferences for physical play.

Contemporary perspectives on child development recognise the interconnected nature of the child, environment and behaviour (Evans, 2021). The bioecological model considers the influence of context on development (Bell et al., 2020). Recent research suggests that children are beginning preschool and school with fewer movement skills than children had 10 years ago (Soan, 2021). This suggests that the contexts in which children currently learn and grow are generating challenges for physical development.

Many contextual factors can affect physical development, including natural and built environments, socio-economic factors, and parenting beliefs and practices.

Recent theory acknowledges that ethnicity is also an influential factor, as culture influences how infants are raised, the expectations of children and what is prioritised as a child learns and grows (Arnett et al., 2018). For example, some cultures prioritise an infant walking as early as possible, while others value independence in self-feeding (Arnett et al., 2018). Each child's developmental pathway is individual, as social and cultural norms shape and encourage developmental skills (O'Connor & Daly, 2016; Shonkoff, 2003).

As children grow, they also develop the skills and knowledge to help shape their own physical development trajectories. Promoting a sense of ownership and responsibility for health in children can improve physical skill development (Slováková et al., 2022). Encouraging physical activity in early childhood can also foster positive attitudes towards exercise (Preedy et al., 2022). ECEC services have an important role in fostering children's ability to promote their own physical health and wellbeing, within the scope of each child's preferences and abilities.

Physical development enables many other forms of learning and development

The EYLF V2.0 encourages active play, not only to foster physical development, but also to enhance children's independence, exploration, relationships and mental wellbeing.

Physical development is closely linked to other domains, such as communication, cognition, and social development. For example, the control of speech organs requires motor development, and climbing activities can develop a child's knowledge of spatial-relational terms, such as 'in front of', 'behind', 'underneath' and 'beside', which are important in early language development (Carson et al., 2016). Moving the body in relation to other people and objects can support the development of spatial awareness, which is an important aspect of mathematical thinking (Case-Smith, 2015).

Physical development also supports healthy brains. More frequent or longer periods of physical activity in children under 5 years have been shown to have positive effects on executive function. This is thought to be due to the growth of new neurons and increased blood flow to different regions of the brain (Carson et al., 2016). Functional MRI studies have noted co-activation of certain brain areas during the performance of both motor and cognitive tasks (Veldman et al., 2019). Data from the Longitudinal Study of Australian Children supports the brain and body connection, showing that physical development and cognitive outcomes are closely associated (Ulker, 2016).

Physical skills enable many behaviours required for other learning. For example:

- Children need to sit and maintain attention over increasing periods as they proceed through school, so postural control is a critical skill, and also enables independent toileting (Case-Smith, 2015; Soan, 2015).
- Children's physical ability to communicate and take care of their personal needs in ways that are consistent with societal and cultural norms supports the formation of friendships and social relationships (Arnett et al., 2018).
- Motor skills allow a child to move physically so that they can interact with objects and people, and participate in tasks, contexts and environments (Mulligan, 2014). Mastery of motor skills contributes to a child's sense of self-efficacy and agency, strengthening their identity as a capable, competent learner (Veldman et al., 2019).

Further research

These insights provide a glimpse of the breadth of literature for each of the learning trajectory domains, and how they develop in early childhood. They also show how each domain can be examined from a range of social, developmental, biological and other perspectives. It is hoped that these selected insights will help to inspire teachers and educators to continue exploring emerging research in each domain, and building their expertise as part of their ongoing professional learning. Insights from the evidence can complement the practical understanding of children's learning and development that teachers and educators build every day, deepening professionalism and practice.

Insights from validated assessment tools

Many tools already exist for assessing children's learning and development in the 5 learning trajectory domains. The Australian Early Development Census (AEDC) is a major 3-yearly assessment of learning and development outcomes in the first year of school across Australia. Other early childhood assessment tools are used (or are under development) in individual states and territories, while others are used in research.

Comparing the AERO learning trajectories with these tools helps strengthen confidence in the content validity of the learning trajectories (how well they cover all parts of each domain). It also helps show how the trajectories can be used alongside other types of assessment tools to deepen teachers' and educators' understanding. By examining similarities and differences between the trajectories and other tools, it is easier to see how the trajectories are unique and how they can complement other assessments.

Two analyses were involved in comparing the trajectories with assessment tools:

- **Alignment with the AEDC** was examined by AERO, using comparisons with learning progressions that were empirically derived from AEDC data.
- **Alignment with assessment tool** was examined by ACER (Appendix B). While data from these tools was not available, the comparison focused on the content of domains, subdomains and strands, and how they aligned with assessment items.

Findings from each analysis are presented below. Overall, they show that the learning trajectories are unique relative to other tools in their scope, structure and use, but also have sufficient alignment with assessment tools to support confidence and compatibility.

Alignment with the AEDC

The AEDC is a measure of children's learning and development in the first year of school. While its purpose is different from the learning trajectories (the AEDC is a point-in-time assessment designed to collect data at community level, rather than a resource for analysing individual children's progress over time), it covers 5 similar domains:

- Physical health and wellbeing
- Social competence
- Emotional maturity
- Language and cognitive skills (school-based)
- Communication skills and general knowledge.

The AEDC data set comprises assessments of each child (de-identified) against the items that make up each domain. Using the Rasch method of analysis, this data can be used to determine the relative 'difficulty' of each item: 'difficult' items are achieved by fewer children, while 'easy' items are achieved by more. Ordering AEDC items by difficulty creates a scale of easier to harder items. This scale can then be used to test whether the indicators in the learning trajectories follow a similar progression of skills. 'Easier' AEDC items are expected to align with earlier indicators on the trajectories.

Research question

Is the sequence of indicators within each strand of the learning trajectories consistent with the relative difficulty of corresponding items in the AEDC?

If yes, this would build confidence in the validity of the learning trajectories. If no, this would identify areas of learning and development that warrant further examination.

Method

The analysis involved the following steps:

1. **Identify corresponding AEDC items for each learning trajectory**

   A list was created of AEDC items that best matched the indicators in the learning trajectories. As the AEDC domains and learning trajectory domains are structured differently (for example, mathematical thinking items are found in the language and cognitive skills domain of the AEDC), items could be matched in any domain. Where more than one AEDC item matched a learning trajectory indicator, both items were included in the analysis. If the items had different difficulty levels, this helped to describe a range of difficulty for the indicator (upper and lower bounds).

2. **Create a scale of AEDC items within each learning trajectory domain**

   The corresponding AEDC items within each learning trajectory domain were ordered into scales, according to their level of difficulty, using Rasch analysis.

3. **Compare the order of AEDC items with corresponding indicators in each strand**

   For each domain in the learning trajectories, we identified the strands that had at least 2 indicators that had been matched to AEDC items, and had corresponding difficulty estimates. This enabled the order of items in the scales to be checked against the order of indicators in the relevant learning trajectory strands.

Results

Key findings from the analysis are described below (see Appendix A for details):

- **Some learning trajectory domains match the AEDC more closely than others**

  The percentage of indicators that could be matched to a corresponding AEDC item (or items) differed across the 5 learning trajectory domains. The language and communication trajectory had the highest proportion of matches (83.3%), while physical development had the lowest (41.7%). This reflects the different ways in which domains of learning and development can be conceptualised. For example, the AEDC has few items related to mathematical thinking, and items related to physical development have a narrower scope than the relevant learning trajectory. The AEDC also does not address flexible thinking (executive functions learning trajectory) or aspects of identity (social and emotional learning trajectory).

- **Most learning trajectory strands align with the order of matched AEDC items**

  There were sufficient matches between AEDC items and learning trajectory indicators to test the alignment of most learning trajectory strands. In almost all cases, the order of AEDC items and order of indicators was found to be aligned.

  Only 4 strands that could be tested were found not to align. The inconsistencies all resulted from differences in how 2 aspects of learning were represented:

  – *Self-control* appears in a relatively easy AEDC item. The matched indicators in the learning trajectories include more advanced aspects of self-control, such as 'perseverance and willingness to delay gratification' (executive functions).
  – *Curiosity about the world* appears in a relatively difficult AEDC item. The matched indicators in the learning trajectories reflect more foundational aspects of learning, such as 'investigate the world' (mathematical thinking).

  Because these 2 aspects of learning were found in multiple learning trajectories, they account for all 4 non-aligned strands. They also demonstrate the flexibility in how aspects of young children's learning and development may be described and defined, and the challenges of creating an ordered sequence of learning.

Insights

Insights from this analysis can help teachers, educators, leaders and policymakers to use the learning trajectories and AEDC in distinct but complementary ways.

Progress in the learning trajectory domains can support AEDC outcomes

The learning trajectories include many aspects of learning and development also measured in the AEDC. This means that children's progress, as described using the learning trajectories, can be expected to contribute to their AEDC outcomes.

The learning trajectories cover different aspects of learning and development

Many indicators in the learning trajectories could not be matched to the AEDC items. In some cases, this reflected a broader interpretation of the relevant domain in the learning trajectories, suggesting that they cover a wider scope of learning. It may also reflect the focus of the AEDC on the first year of school, which means that the earliest stages of some domains may not be reflected in the AEDC items.

Learning trajectories can complement point-in-time assessments

Each child only undertakes one AEDC assessment (if they are in a relevant cohort), so it is not designed to capture their progress along a learning continuum. The learning trajectories can help extend teachers' and educators' understanding of point-in-time assessments by showing the learning and development that occurs before and after the learning being assessed. This makes assessment results more useful for planning next steps in learning and helps highlight the underlying skills that children can develop to improve AEDC outcomes for their community.

Alignment with assessment tools

ACER reviewers explored the alignment between the learning trajectories and tools used for assessing children's learning and development. This built on the AEDC analysis (see pages 24–26), to deepen understanding of how the learning trajectories reflect existing ways of measuring the 5 domains, while also offering new ways of engaging with them.

Previous ACER research has identified key features of learning progressions, which were used to guide the analysis (Waters & Ramalingam, 2019). These are:

- **breadth** – scope of learning and development covered
- **divisions** – how the learning area is structured (for example, subdomains, strands)
- **vertical range** – span between lowest and highest level
- **transitions** – size of gaps or 'jumps' between indicators
- **descriptions** – level of detail, and what is covered (for example, misconceptions, practices).

The analysis aimed to explore the similarities and differences between AERO's learning trajectories and assessment tools across as many of these features as possible.

Research question

How well do the learning trajectories align with other relevant assessment tools, in terms of breadth, divisions, vertical range, transitions and descriptions?

If strong alignment is found, this would further build confidence in the validity of the trajectories and identify assessment tools that the trajectories complement best.

If weak alignment is found, this would signal areas of learning and development to be examined more closely, and also highlight the trajectories' unique contribution.

Method

The analysis involved the following steps:

1. **Identify assessment tools for comparison**

   The assessment tools for comparison were identified through ACER's previous work compiling assessments of early learning, as well as development of new tools such as the *International Early Learning and Child Wellbeing Study* (IELS). Tools were selected based on coverage of relevant domains; accessibility (to researchers, educators and teachers); and the existence of a robust evidence base. Tools used across Australia were prioritised, although some state-based tools were included because they offered particular insights. A full list of assessment tools is provided at Appendix B.

2. **Identify notable similarities and differences across all features for comparison**

   The ACER team mapped the learning trajectory domains, subdomains, strands and indicators to the selected tools, considering all the features for comparison above. The method drew on ACER's previous experience mapping learning progressions, as well as team members' expertise in specific areas of learning and development.

Insights

The analysis confirmed that AERO's learning trajectories are generally fit for purpose and robust in their current form. At the same time, differences between the trajectories and the assessment tools yielded valuable insights to guide their use in practice.

Results from ACER's extensive analysis are condensed below into key insights under each of the 5 features for comparison, supported by the most relevant examples.

The **breadth** of the learning trajectories supports holistic approaches

The learning trajectories cover a broader range of learning and development than most of the early years assessment tools, thereby supporting the EYLF V2.0 principle of holistic, interconnected and integrated learning. Examples from the analysis included:

- The Abilities Based Learning and Education Support (ABLES) tool has the widest breadth, covering 9 areas related to the Australian Curriculum. While designed for assessing children with disabilities, ABLES and Early ABLES (which was not available for comparison in this desktop review), are also used in ECEC services in some jurisdictions.
- IELS and the Early Years Toolbox (EYT) cover most learning trajectory domains, including language/literacy, mathematics/numeracy, executive functions and social and emotional development. Neither tool focuses on physical development.
- The Queensland Kindergarten Learning Guidelines (QKLG) is structured around the ELYF learning outcomes: communication, identity, active learning, connectedness and wellbeing, rather than domains. This suggests potential for further mapping of learning trajectory domains to these outcomes.
- While ABLES and QKLG cover some parts of the physical development learning trajectory, there were fewest assessment tools for this domain overall. The reviewers explored developmental milestone checklists in this domain but noted that these serve a different purpose from assessments or trajectories.
- A general finding is that many indicators in the learning trajectories demonstrate the interconnectedness of the 5 domains. For example, the indicator on collaborative play (social and emotional learning trajectory) also involves executive functions and language and communication.

These differences show that there is no single universal approach to defining the breadth of early learning and development. They also suggest potential for further work to map the learning trajectories to assessment tools that cover specific learning trajectory domains, as new tools are developed in some jurisdictions.

The **divisions** in the learning trajectories unpack the complexity of each domain

The learning trajectories use a consistent number and structure of subdomains, strands and indicators to organise the components of each domain. This enhances clarity and usability across domains relative to some assessment tools that are designed to unpack a narrower range of constructs, or a different degree of complexity. Comparison was more challenging when these structures were not aligned. Examples included:

- Some assessment tools focus on specific strands of the learning trajectories. For example, the Pattern and Structure Mathematical Awareness Program (PASMAP) covers the patterns and predictions strand of the mathematical thinking learning trajectory, while the Learning Framework in Number (LFIN) tool addresses 'quantity and counting'. In relation to social and emotional learning trajectory, the Theory of Mind (ToM) tool covers the self-awareness and social awareness subdomains, while the Pretend Play Checklist (PPC-T) is mainly related to social management.
- Some assessment tools divide subdomains of the learning trajectories differently. For example, EYT separates 'phonological' and 'visual spatial' working memory, whereas the executive functions learning trajectory combines language and visual information in its working memory subdomain.
- Even when assessment tools divide domains into similar numbers of components, they may describe these differently from the trajectories. For example, ABLES Reading and Viewing has 3 strands: 1) text structure and organisation, 2) phonics and word knowledge, and 3) expressing and developing ideas. The 3 strands of the language and communication learning trajectory include similar constructs, but identify enjoyment of reading as its own strand.
- The QKLG, which is organised into EYLF outcomes, situates items related to learning trajectory domains under what is seen as the most relevant outcome. For example, the QKLG 'identity' domain includes *Acting with independence and perseverance*, which was matched to the executive functions trajectory. Other executive functions indicators matched the QKLG 'wellbeing' domain. This shows how learning trajectory domains support multiple EYLF outcomes.
- Some strands of the physical development learning trajectory were combined in other tools; for example, fine motor skills usually formed a single strand. The expansion into 3 strands in the trajectory (moving muscles, manipulating small objects and coordinating small movements) is intended to draw teachers' and educators' attention to the many possible indicators for this subdomain.
- Some assessment tools break subdomains into smaller components than the AERO strands. For example, EYT breaks inhibition control (executive functions learning trajectory) into cognitive, behavioural and social-emotional aspects.
- In some assessment tools, aspects of the executive functions learning trajectory were visible in the self-regulation domain. This reflects the different ways that these 2 constructs may be structured in research (see previous section).
- Some components of the trajectories did not match any components of the assessment tools. For example, the physical health and self-care subdomain (physical development learning trajectory) did not appear in other tools but did map to some items in ABLES, such as identifying the need for sleep or rest.

These differences in structure not only reflect different perspectives on learning, but also the different purposes of the various tools. The structure of the trajectories is designed to show the many constructs within each domain, whereas assessment tools are often organised to make measurement as clear and efficient as possible.

The **vertical range** of the learning trajectories needs to be interpreted flexibly

The learning trajectories are designed for use in services with children from infancy through to the year prior to starting school. However, the learning trajectories' indicators are not associated with specific age ranges. The analysis affirmed that the range of learning and development covered in the trajectories is best interpreted flexibly and may align with different ages. Examples included:

- ABLES shows how some early indicators of learning and development may appear at school age for children with disability. Seeing these as indicators of progress rather than age-based steps supports a focus on children's strengths.
- Comparisons between the mathematical thinking learning trajectory and other tools illustrated the different ways that vertical ranges could be defined. IELS (for children 5 years of age) included more demanding items than the higher end of the learning trajectory. Conversely, one expert reviewer argued that some of the indicators in that trajectory do not usually appear until primary school.
- The EYT apps (for children from 3 to 5 years of age) indicate the flexibility in the link between age and ability, by reporting on whether a child falls within age expectation (middle 60%), above (top 20%) or below (bottom 20%) (Dawson et al., 2020).
- One expert reviewer noted that the learning trajectories do not indicate when subdomains develop sequentially; for example, receptive language skills may be seen as developing before expressive skills. This reflects the learning trajectories' goal to show each strand from its earliest stages; for example, showing that non-verbal expressive communication begins in infancy.

As many assessment tools focus on children from 3 to 5 years of age, comparison with the entire vertical ranges of the learning trajectories was limited by the lack of tools covering the earliest years of life. This suggests that the trajectories may fill an important gap.

The **transitions** between indicators in the learning trajectories are also dynamic

The learning trajectories are structured into 4 columns per strand, each containing an indicator of how children may progress along a continuum of learning. It is not expected that all children will progress along each continuum at the same rate, or that columns represent 'equal' amounts of learning. In contrast, assessment tools usually use more precise, measured approaches to describing transitions. Examples of alternative approaches included:

- EYT measures changes across its 8 levels of working memory simply by increasing the number of items a child can hold in their working memory. In contrast, the executive functions learning trajectory describes changes in the complexity of information and the level of support or prompting required.
- The social and emotional learning trajectory describes changes similarly to ToM self-awareness, by moving from simple to more complex skills; but somewhat differently from ABLES in social management, by focusing on broader social strategies rather than their awareness of the effects of their actions on others.

- The mathematical thinking learning trajectory was noted to have larger 'jumps' between indicators in the measurement and data subdomain than comparable tools; although this may reflect different interpretations of these indicators. For example, children 'discuss the volume of materials' (learning trajectory) could include the use of informal terms rather than formal mathematical language.
- In the language and communication trajectory, some indicators in the last column of the emergent writing subdomain were also identified as a larger 'jump' than in other tools, such as 'begin to understand spelling conventions'. In contrast, ABLES and QKLG use words like 'experiments' and 'attempts' at this level. This also depends to some extent on how the indicators are interpreted.

Again, these differences in part reflect differences in purpose. Uniform transitions between items and indicators are important for measurement tools that require children's learning to be situated with precision along a continuum. In contrast, the learning trajectories provide broad ranges in which children's learning may occur.

The **descriptions** in the learning trajectories encourage deep, gradual learning

A common finding in the analysis was that the learning trajectories cover the domain or strand in greater detail than the assessment tools. Occasionally, the reverse was true, especially for tools focused on smaller gradations of learning for narrower age ranges. Examples of both scenarios from the analysis included:

- Some learning trajectory indicators contain multiple aspects of learning, in contrast to assessment tools that measure one aspect of learning at a time. For example, one indicator in the mathematical thinking learning trajectory contains constructs related to sorting, describing proximity and classifying shapes. Reviewers noted that this broad description contrasted with tools that measure whether the child had attained specific knowledge or skills.
- The executive functions learning trajectory includes words associated with feelings that are not present in the assessment tools, reflecting their recognition of the affective dimension of learning and development. For example, it mentions that the children 'enjoy exploring' or 'remain calm'.

- The mathematical thinking learning trajectory does not explicitly use terms used in literature and other tools, such as 'cardinality' and 'abstraction'. This reflects the trajectories' goal to summarise learning in accessible ways, but also indicates that other tools could help deepen learning in this area.
- The reviewers also noted concepts that appear more strongly in the assessment tools than in the learning trajectories. For example, ABLES and IELS have clearer indicators related to receptive vocabulary than the language and communication learning trajectory. ABLES also gives greater prominence to children's use of images as part of the development of early literacy.
- Some assessment tools include direct assessments to measure aspects of learning and development, such as a 'Go/No Go' game in EYT and IELS. In contrast, the learning trajectories are intended to support open-ended approaches to assessment, integrated within child-led, play-based learning.

Overall, the learning trajectories contain more detail than tools that are focused on a single domain or used in specific point-in-time assessments. While the level of detail in the learning trajectories may be daunting at first, teachers, educators and leaders recognised that they can engage with one trajectory at a time – or even with one subdomain or strand. As their familiarity with each domain grows, teachers and educators may feel motivated to explore how it is represented in assessment tools.

Further validation

Overall, this analysis increased confidence in the *content validity* of the learning trajectories by showing how they contain elements of validated measurement tools. At the same time, it demonstrated the uniqueness of the learning trajectories in covering a more complete set of domains than most other tools, often in greater detail. This uniqueness reflects the difference in purpose between the learning trajectories and the tools used for comparison. While other tools aim to measure learning and development with precision – and therefore require a narrower approach – the trajectories are designed to inform broader, deeper and richer observations.

The comprehensiveness of the learning trajectories points to another potential future use: as a resource for connecting insight from multiple assessments into an integrated learning continuum. This possibility may be valuable as the range of assessment tools used in Australian ECEC services continues to increase, including various qualitative observational methods and state-based assessments. Any form of assessment could be mapped to the learning trajectories, whether it is item-based or in narrative form.

The differences between the learning trajectories and the assessment tools show how no single tool produces a definitive description of any one domain. At the same time, the analysis points to potential for further validation of the learning trajectories, to refine the indicators and support the reliability of teachers' and educators' judgements about children's progress. These opportunities will be explored as the learning trajectories are implemented, and as more insights are gained about their use.

Conclusion: A case for validity

The early childhood learning trajectories are informed by a broad, diverse evidence base, as this report has shown. This includes theoretical and empirical literature on how young children learn and develop, and comparisons with relevant assessment tools. The trajectories are also informed by extensive consultation and early field testing with teachers, educators, leaders and policymakers in the ECEC sector. These consultations, alongside the evidence, guided the learning trajectories' purpose, content and design.

The first aim of this report was to strengthen confidence in the learning trajectories as a robust tool for practice. The different types of evidence and insight each contribute to building the case for the trajectories' validity. Arguments for their validity include:

- **The learning trajectories are based on rigorous research**, drawing on relevant literature on children's learning and development in each of the 5 domains.
- **The learning trajectories generally align with validated assessment tools**, while also offering broader coverage across domains, especially for early stages of learning.
- **The learning trajectories are fit-for-purpose**, based on their successful initial field trial; subsequent refinement based on input from teachers, educators, leaders and policymakers; and alignment with approved learning frameworks for ECEC.

As the learning trajectories progress from development to implementation, further insights about their validity will emerge as teachers and educators put them to use. Most important will be their *consequential validity*[2] – that is, their impact on practice, and the consequences of using the learning trajectories to lift quality and outcomes.

The second aim of this report was to provoke reflection and further exploration of the learning trajectory domains. A clear theme throughout the evidence base is that early learning and development can be defined and described in many different ways. Even shared definitions of a domain can contain different perspectives on how its components are delineated, divided and described. Exploring these perspectives, and learning from the research and each other, has been a highlight of creating the learning trajectories for the development team. The hope is that teachers, educators, leaders and policymakers will continue the conversation, and use the trajectories to stimulate rich collegial discussions and ongoing professional learning.

2 Types of validation are detailed in this ACER report: Jackson, J., & Nietschke, Y. (2018). Validating professional standards for teachers: A practical guide for research design. ACER. https://research.acer.edu.au/teaching_standards/15

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Appendices

Appendix A: Alignment of learning trajectories to AEDC scales

Table 1 shows the number of matched indicators, number of matched indicators per strand (shown as the number of strands with each number of matched indicators), and number of testable and aligned strands for each learning trajectory domain.

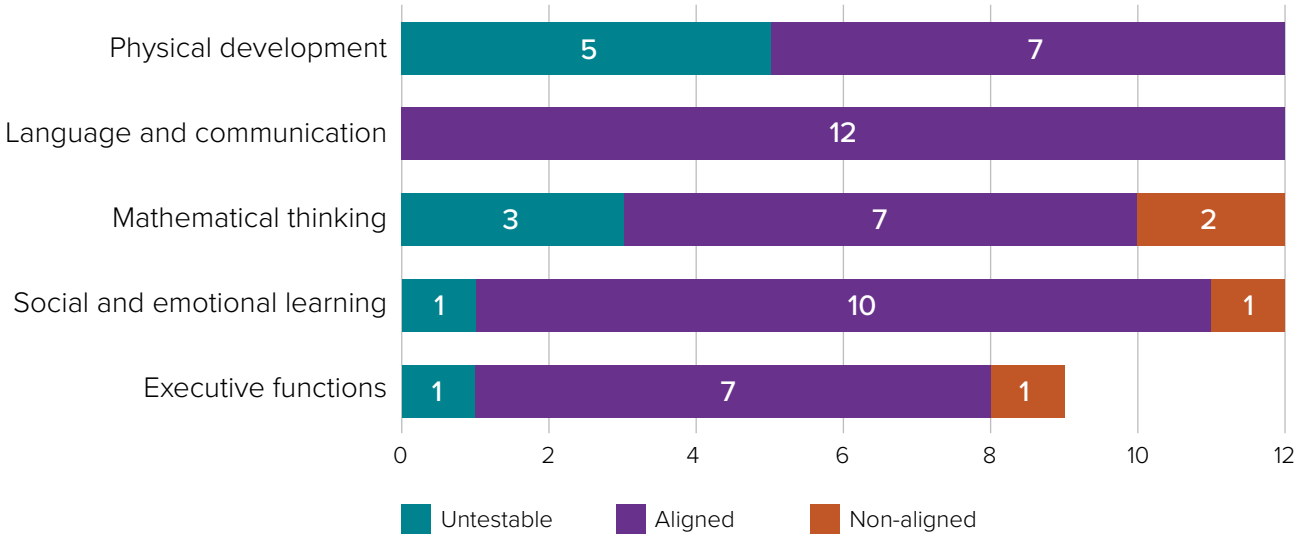
For example, for the language and communication learning trajectory, 40 from 48 indicators could be matched. All strands had at least 2 matched indicators, therefore all 12 strands could be tested, and all were found to align with the AEDC scales.

Table 1: Results of alignment of learning trajectory indicators and strands to AEDC scales

Learning trajectory domain	Indicators matched to AEDC items	Number of matched indicators per strand (2 or more = testable)					Testable strands	Aligned strands
		4	3	2	1	0		
		Testable			Not			
Executive functions	25/36	1	6	1	1	0	8/9	7/8*
Social and emotional learning	34/48	3	5	3	1	0	11/12	10/11*
Mathematical thinking	24/48	0	3	6	3	0	9/12	7/9**
Language and communication	40/48	4	6	2	0	0	12/12	12/12
Physical development	20/48	0	2	5	3	2	7/12	7/7

* Non-aligned strands attributable to AEDC item 'Would you say this child demonstrates self-control?'
** Non-aligned strands attributable to AEDC item 'Would you say this child is curious about the world?'

Figure 1: Number of untestable, aligned and non-aligned strands within each domain



Appendix B: Assessment tools used in ACER analysis

Table 1: Comparison instruments: Executive functions

Instruments	Domain and subdomains	Owner	Status/Access	Focus
EYT	Self-regulation • Visual-Spatial Working Memory • Phonological Working Memory • Inhibition • Shifting	Early Start, University of Wollongong	App and website commercially available	2½ to 5 year olds
IELS	Self-regulation • Inhibition • Working memory • Mental flexibility	OECD	Published	5 year olds
QKLG	• Identity • Active learning	Queensland Curriculum and Assessment Authority	Published	3 to 5 year olds

Table 2: Comparison instruments for Mathematical thinking

Instruments	Domain and subdomains	Owner	Status/Access	Focus
ABLES Towards Foundation Mathematics	Mathematics • Number and Algebra • Measurement and Geometry • Statistics and Probability	Department of Education and Training Victoria	Published as Victorian Curriculum Levels A to D	Learners with disability
IELS	Emergent numeracy • Numbers and counting • Working with numbers • Measurement • Shape and space • Pattern	OECD	Published	5 year olds

Instruments	Domain and subdomains	Owner	Status/Access	Focus
LFIN	Quantity and counting • Counting • Grouping • Number words and numerals	Wright Mathematics Recovery	Published – available for purchase	Number subdomain
PASA	Patterns and predictions	ACER	Published – available for purchase	Patterns subdomain
PAT-M	Mathematics	ACER	ACER access	Matches to indicators further along the trajectory
QKLG	Communicating	QCAA	Published	Subdomain match 3 to 5 year olds

Table 3: Comparison instruments for social and emotional learning

Instruments	Domain and subdomains	Owner	Status/Access	Focus
ABLES Towards Foundation Personal and Social Capability	• Self-awareness and management • Social awareness and management	Department of Education and Training Victoria	Published as Victorian Curriculum Levels A to D	Learners with disability
IELS	• Empathy • Trust	OECD	Published	5 year olds
QKLG	• Connectedness • Wellbeing	Queensland Curriculum and Assessment Authority	Published	3 to 5 year olds
PPC-T	Role play	Stagnitti & Paatsch. Learn to Play	Published	4 to 7 year olds
ToM	• Interpersonal cognitive • Intrapersonal cognitive • Interpersonal affective • Intrapersonal affective	Westby & Robinson	Published	Birth to 10 year olds

Table 4: Comparison instruments for language and communication

Instruments	Domain and subdomains	Owner	Status/Access	Focus
ABLES Towards Foundation English	English • Reading and viewing • Writing • Speaking and listening	Department of Education and Training Victoria	Published as Victorian Curriculum Levels A to D	Learners with disability
EYT	Expressive vocabulary	Early Start University of Wollongong	App and website	2½ to 5 year olds
IELS	Emergent literacy • Listening comprehension • Phonological awareness • Vocabulary	OECD	Published	5 year olds
PAT-R	Reading • Decoding – phonics and phonemes • Decoding – print conventions and environmental • Comprehension	ACER	ACER subscription	Matches to indicators further along the trajectory
QKLG	Communicating • Exploring and expanding language • Exploring sounds and letters • Exploring reading and writing	Queensland Curriculum and Assessment Authority	Published	3 to 5 year olds

Table 5: Comparison instruments for physical development

Instruments	Domain and subdomains	Owner	Status/Access	Focus
ABLES Health and Physical Education	Health and Physical Education • Personal, social and community health • Movement and physical activity	Department of Education and Training Victoria	Published as Victorian Curriculum Levels A to D	Learners with disability
Fine motor development instrument	Fine motor development	ACECQA	Published	0 to 5 years old
Gross motor development instrument	Gross motor development	ACECQA	Published	0 to 5 years old
QKLG	Wellbeing • Ways to be healthy and safe • Promote physical wellbeing	Queensland Curriculum and Assessment Authority	Published	3 to 5 year olds

Description of comparison instruments

This appendix outlines the assessment tools selected by ACER for comparison with the learning trajectories.

The ACER team gave priority to tools that addressed domains or subdomains related to the 5 learning trajectory domains. These included tools that mapped directly to the learning trajectory domains, or that could be mapped to learning trajectory domains by combining subscales or items. The preference was for comparison instruments that have a national Australian user base, but, where a state-specific instrument was published and appropriate, this was used. For example, the QKLG was selected as it covered children 3 to 5 years of age and included a form of progression, whereas checklist tools such as the Tasmanian Kindergarten Development Checklist (KDC) (where K=5-year-old school entry) did not add significantly to the review – although the KDC's development activities are a value-add for educators.

Detailed descriptions of each instrument are provided on the following pages, such as:

- Access: The website address or details of how to access the instrument.
- Publisher: The publisher of the instrument (if published).
- Developer: The developer/s of the instrument.
- Intended use: The instrument's stated purpose.
- Level: The age/s for whom the instrument is intended.
- Notes: Any additional information about relevance, validity, or use of the instrument.
- Domains and subdomains: Which domains and subdomains are covered by the instrument, as relevant to AERO.

Abilities Based Learning and Education Support (ABLES)

Access

https://www.education.vic.gov.au/school/teachers/learningneeds/Pages/ables.aspx

Publisher

Department of Education and Training Victoria

Developer

The University of Melbourne 2008, derived from the Students with Additional Needs (SWANS) assessment and reporting materials (Griffin and Woods 2020). https://www.education.vic.gov.au/school/teachers/learningneeds/Pages/ables.aspx#link52

Intended use

ABLES was initially designed to assess students with significant intellectual and multiple disabilities in special school contexts. Over the past 12 years, ABLES has also been increasingly used in mainstream settings as a tool for differentiation (Queensland Curriculum & Assessment Authority [QCAA], 2021). ABLES is being used in Victoria, Western Australia and South Australia, and is on trial in ACT, Queensland and Northern Territory (as of March 2020). https://victoriancurriculum.vcaa.vic.edu.au/overview/diversity-of-learners

Level

The 'Towards Foundation Level Victorian Curriculum' is integrated directly into the curriculum and is referred to as 'Levels A to D'. 'Levels A to D' are not associated with any set age or year level.

ABLES Domains and subdomains

In 2022, the ABLES framework, as mapped to the Australian Curriculum and Victorian Curriculum, included the following domains and subdomains relevant to the learning trajectories:

- Mathematics
  - Number and algebra
  - Measurement and geometry
  - Statistics and probability.
- English
  - Reading and viewing
  - Writing
  - Speaking and listening.
- Personal and social capability
  - Self awareness and management
  - Social awareness and management.
- Health and Physical Education
  - Personal, social and community health
  - Movement and physical activity.
- Critical and creative thinking
  - Questions and possibilities
  - Reasoning
  - Meta-Cognition.

EARLY ABLES Domains and subdomains

Early ABLES is a version of ABLES designed for children with disabilities from 2 years of age, also developed by The University of Melbourne Assessment Research Centre. Early ABLES is accessed by educators via an online portal but was not available to reviewers.

In 2022 there were 8 Early ABLES assessments aligned with the 5 Learning and Development Outcomes of the Victorian Early Years Learning and Development Framework (VEYLDF).

- Identity and community – Social: Skills and understandings in social interaction, autonomy, responsibility and care for others

- Wellbeing – Emotional: Understanding of the experience and expression of emotions in themselves and others
- Learning dispositions: Skills related to attention, memory and independence that lead to an increased sense of confidence as a learner.
- Communication – Interactions: Child's interactions, and communication skills, including the social conventions surrounding communication, both verbal and non-verbal
- Communication – Symbols and Text: Representation of symbols and text, and use and interpretation of symbols and text as a medium for communication.
- Learning and communication – Numeracy
- Wellbeing – Movement
- Identity and learning – Thinking skills.

ACER Learning Progressions

Access

Learning Progression Explorer
https://learning-progression-explorer.acer.org

Publisher

ACER 2018

Developer

UNESCO Institute for Statistics (UIS) and ACER's Centre for Global Education Monitoring (GEM)

Intended use

To support the building of comparable global indicators of learning outcomes to describe and quantify learning progress in reading and mathematics as part of the United Nation's Sustainable Development Goals (SDG) 4.

Level

Level 1 of these Learning Progressions is relevant to the learning trajectories.

Notes

The description for each level comprises a 'nutshell' summary statement, and an elaboration of the understandings and skills that are typically associated with the level.

Domains and subdomains

Mathematics

Progress in mathematics is considered from 2 perspectives.

Three content areas

1. Number and algebra
2. Measurement and geometry
3. Statistics and probability.

Four interrelated competencies:

1. Conceptual understanding
2. Procedural fluency
3. Strategic competence
4. Adaptive reasoning.

Reading

At this stage the progression in reading is only available from Level 7, which is beyond the scope of the AERO learning trajectories. The focus of the learning progression for reading comprehension is on making meaning from written text, recognising that understanding requires the development of vocabulary and comprehension skills in the language, first in their oral forms – that is, comprehension skills develop initially as skills in listening comprehension.

Reading comprehension: Text form and purpose, Critical perspectives, Interpreting meaning, and Searching.

Early Years Toolbox (EYT)

Access

App and website http://www.eytoolbox.com.au

Publisher

University of Wollongong 2013

Developer

Early Start University of Wollongong

Intended use

An accessible, objective measurement of young children's abilities, for educator and research use.

Level

Children 3 years to 5 years 11 months of age

Notes

Rather than presenting a progression, the EYT apps report on whether a child falls within age expectation (middle 60%), above age expectation (top 20%) or below age expectation (bottom 20%) (Dawson et al., 2020).

The EYT website publishes preliminary norms from a sample of children with representation of SES, gender, maternal education, age and Indigeneity. While this sample was not a purposefully selected normative sample, it is seen to yield good developmental sensitivity, and provides the ability to compare results against these preliminary norms. A full report on the analytic sample and norms generated can be found in Howard and Mellhuish (2017).

Domains and subdomains:

- Executive function
  - Visual spatial working memory: How many different spatial locations children can hold in mind at any one time (Mr. Ant app).
  - Phonological working memory: How much auditory information can children remember at any one time (Not this app).
  - Inhibition: The ability to overcome urges or behaviours that children need to override (Go/No Go app).
  - Shifting: The ability to flexibly move attention from one thing to the next (Card sort app).
- Expressive vocabulary task which measures ability to produce words to characterise different images, i.e., I see a picture can I produce the word that labels that picture.
- Self-Regulation and Social Development
  - Self-Regulation: The extent to which children persist in a challenging task, overcome frustration, and stay within the rules of the activity, for example a group-based memory card game with a high degree of challenge.
  - Cognitive self-regulation: The extent to which children sustain attention and resist distraction.
  - Behavioural self-regulation: The extent to which children take turns, and follow the rules.
  - Social-emotional: The extent to which children cope with frustration and support or encourage others in the game.
- Early numeracy
  - Early numerical concepts and language
  - Early spatial and measurement concepts
  - Counting a subset
  - Identifying digit and quantity
  - Matching digit and quantity
  - Completing number lines
  - Number comparison
  - Ordinal position
  - Conceptual subitising
  - Discerning and completing patterns
  - Numerical word problems
  - Numerical equations.

International Early Learning and Child Well-being Study (IELS)

Access

https://doi.org/10.1787/af403e1e-en

Publisher

OECD 2021

Developer

OECD Consortium (ACER, IEA & cApStAn)

Intended use

A measure designed to provide valid, reliable and comparable information on children's early development for use in global assessment at 5 years of age.

Level

5 years of age

Notes

International validated assessments of Executive Function (called Self-Regulation in IELS). 'As this is the first IELS study, the scale established will be linked to in any future study in order to establish trends. In following the tradition of the other OECD studies, the outcome domains were scaled and transformed such that they have an international mean 500 and a standard deviation 100' (OECD, 2021, p. 114).

Domains and subdomains

- Emergent literacy
  - Listening comprehension
  - Phonological awareness
  - Vocabulary
  - Plus indirect assessment by parents and teachers rating expressive and receptive language.
- Emergent numeracy
  - Numbers and counting
  - Working with numbers
  - Measurement
  - Shape and space
  - Pattern
  - Plus indirect assessment by parents and teachers rating emergent numeracy across a range of indicators.
- Social and emotional
  - Empathy
  - Trust (Parent and teacher questionnaire)
    - » Approaches familiar adults for comfort when upset.
    - » Is confident around adults.
    - » Requires reassurance from adults.
    - » Is hesitant when making requests.
    - » Greets unfamiliar children in a friendly way.
    - » Is confident with other children.
    - » If anxious in an unfamiliar situation, child is not easily reassured.
    - » Openly approaches familiar adults when she/he needs help.
- Prosocial and non-disruptive behaviour indirect assessment items
  - Prosocial
    - » Understands others' feelings, like when they are happy, sad or angry.
    - » Is helpful to other children (for example, if someone is hurt or upset).
    - » Is emotionally moved by the problems of people in books or stories.
    - » Tries to comfort others when they are upset.
    - » Is curious, likes to explore or try new things.
    - » Considers other people's feelings.

    - » Says nice or friendly things to other children.
    - » Joins in with other children playing.
    - » Is unaware of other people's emotions.
    - » Is friendly towards others.
  - – Disruptive
    - » Dislikes it when asked to play in a different way (e.g., frowns, stamps foot).
    - » Prevents other children from doing their own activities.
    - » Gets upset when you don't give him/her enough attention.
    - » Teases other children.
    - » Fights with other children.
- Executive function
  - – Inhibition
  - – Working memory
  - – Mental flexibility.

Learning Framework in Number (LFIN)

Access

Available to purchase

Publisher

SAGE Publications Ltd

Developer

Robert J Wright and David Ellemor-Collins

Intended use

Research-based framework for assessment, instruction, and intervention in whole number

Level

Grades K to 5

Notes

Number focus. Subdomain match.

Domains and subdomains

- Quantity and counting
- Counting
- Grouping
- Number words and numerals.

Pattern and Structure Mathematical Awareness Program (PASMAP)

Access

https://shop.acer.org/pattern-and-structure-mathematics-awareness-program-pasmap-book-1.html. Available for purchase

Publisher

ACER 2016

Developers

Joanne Mulligan and Michael Mitchelmore

Intended use

The Pattern and Structure Mathematical Awareness Program (PASMAP) is built on engaging children in exploring core patterns leading to an improvement in general mathematical understanding.

Level

5 to 7 years of age

Notes

Subdomain match

Demonstrates a relationship between the awareness of mathematical structure as crucial to mathematical competence among young children (Mulligan & Mitchelmore, 2009).

Domains and subdomains

Patterns and predictions.

Pretend Play Checklist for Teachers (PPC-T)

Access

https://www.learntoplayevents.com/product/pretend-play-checklist-for-teachers-ppc-t-manual
Available for purchase

Publisher

Learn to Play

Developer

Karen Stagnitti and Louise Paatsch

Intended use

The PPC-T is a non-standardised criterion-referenced assessment of a child's ability to play. It provides a framework for teachers to observe the pretend play of children, assisting teachers to understand what pretend play looks like, what the stages of development are, how to understand a child's play, and how to report on a child's developing pretend play ability.

Level

4 to 7 years of age (enjoyment checklist is 12 months to 5 years)

Notes

Subdomain match

Domains and subdomains

The PPC-T assesses 5 play skills, each consisting of 9 levels of ability ranging from simple (Level 1) to complex (Level 9).

The 5 play skills are:

- play scripts
- sequences of play actions
- object substitution
- figurine play
- role play.

Progress is the extent of the child's ability to spontaneously initiate their own play.

Queensland Kindergarten Learning Guidelines (QKLG)

Access

https://www.qcaa.qld.edu.au/kindergarten/qklg/learning-development-areas

Publisher

QCAA 2018

Developer

QCAA

Intended use

Describe the knowledge, skills and dispositions that children explore during the kindergarten year. Provides examples of the expected behaviours by the end of the kindergarten year and suggested intentional teaching practices.

Level

3 to 5 years of age

Notes

Developed in 2010 and revised in 2018.
The QKLG is aligned to the EYLF.

The QKLG takes a different approach to describing progression, using language that references the level of support a child requires for a specific skill. For example, indicators describe children undertaking tasks with 'explicit support', 'occasional support' or 'occasional prompting'.

Domains and subdomains

- Communicating
  - Exploring and expanding language
  - Exploring sounds and letters
  - Exploring reading and writing.
- Identity
  - Sense of security and trust
  - Independence and perseverance.
- Active learning
  - Positive dispositions towards learning
  - Confidence and involvement in learning
  - Using technologies for learning and communication.
- Connectedness
  - Positive relationships
  - Respect for diversity
  - Respect for environments.
- Wellbeing
  - Sense of autonomy
  - Ways to be healthy and safe
  - Promote physical wellbeing.

Theory of Mind (ToM)

Access

https://doi.org/10.1097/TLD.0000000000000035

Publisher

Journal: Topics in Language Disorders, 2014

Developer

Westby and Robinson 2014

Intended use

To implement specific intervention strategies to target the linguistic and cognitive/affective foundations for ToM development

Level

Birth to 10 years of age

Notes

ToM is viewed as a multidimensional construct comprising cognitive and affective ToM and interpersonal and intrapersonal ToM, 'each of which has differing neurophysiological/ neuroanatomical foundations and behavioural manifestations' (Westby & Robinson, 2014, p. 362). ToM researchers consider communication as having cognitive, social–emotional, and language components, and state that some of the model's strategies have empirical support; others are based on what is known about typical development and patterns of impairment.

Domains and subdomains

- Interpersonal cognitive
- Intrapersonal cognitive
- Interpersonal affective
- Intrapersonal affective.

For more information visit
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