

ECIE5002

Portfolio

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Component 1

Essay: Why is good numeracy important

Why is good numeracy important?

This essay examines the significance of numeracy across a range of contexts, including political and social domains, everyday life, financial decision-making, social justice, health, and individual attributes.

Numeracy is often narrowly understood as basic mathematical competence; however, broader conceptualisations emphasise its role in applying quantitative reasoning to everyday situations (Munn, 2005).

Although closely related to arithmetic and mathematics, numeracy extends beyond calculation to include the effective use of numerical information to address real-world problems and the willingness to engage with numerical data. Numeracy incorporates not only mathematical proficiency but also confidence and disposition, alongside other competencies such as critical thinking, ethical awareness, social capability, resilience, and creativity (O’Keeffe and Paige, 2019). The OECD (2019) further identifies numeracy as a key component of adult skills, enabling individuals to manage the demands of work, home, and society. From this perspective, numeracy is positioned as a vital life skill rather than a purely academic discipline, integrating problem-solving, reasoning, and critical evaluation.

Numeracy proficiency is essential for effective engagement in daily life, since it enables individuals to do normal tasks and make educated decisions in various circumstances. In practical contexts like cooking and baking, numeracy facilitates accurate measuring, quantity adjustment, and unit conversion (Harper, 2025). In consumer contexts, numeracy enables price comparison and evaluations of value for money. Numeracy transcends mere procedural calculation to include critical numeracy, which entails the interpretation and interrogation of numerical

data within broader social, ethical, political, and environmental contexts. For example, responsible consumer decision-making necessitates the evaluation of sustainability, environmental impact, and fair-trade practices in addition to cost, hence necessitating higher-order analytical skills along with numerical comprehension (Coben, 2026). Numeracy is essential for effective time management, budgeting, and financial planning, allowing individuals to comprehend savings, credit agreements, taxation, and household expenses, hence mitigating the danger of financial exclusion and indebtedness (OECD, 2019). In health-related contexts, numeracy is essential for precise medicine measurement and understanding dose instructions, with data indicating that restricted numeracy correlates with adverse health outcomes (Peters, 2020). Furthermore, in an increasingly intricate and swiftly evolving employment sector, numeracy enhances problem-solving, adaptability, and invention, hence augmenting employability and earning potential. Numeracy may strengthen individuals' numerical confidence, contributing to more effective financial management, particularly during challenging circumstances such as a cost-of-living crisis (National Numeracy, 2025). This corresponds with the Welsh Government's Well-being of Future Generations Act (2015), which underscores the evolution of a healthier, more integrated, and prosperous society. Concerns about insufficient mathematical proficiency in the workforce were initially articulated in the Cockcroft Report (1982), which contended that all students should attain adequate mathematical skills during their education to operate effectively in academia, employment, and daily life, thereby introducing the notion of being 'numerate'. Modern international assessments like PISA define numeracy as the capacity to utilise mathematical knowledge in practical scenarios, highlighting significant worry where performance is relatively deficient, as observed in Wales

(Ingram et al., 2023). Recognising numeracy as an integral life skill may suggest contradiction for educational policy and curriculum development, especially concerning the choice for students to withdraw from mathematical studies at age sixteen. This may raise critical debate regarding the necessity of maintaining compulsory numeracy in formal education, its explicit integration into vocational and career-oriented programs, or its enhancement through employer-driven training initiatives to adequately prepare individuals for substantive engagement in society and the economy (National Numeracy, 2023).

Numeracy is increasingly recognised as an essential component in promoting fairness and equality. In a rapidly evolving world characterised by pervasive data, statistics, and misinformation, numeracy equips individuals with the capacity to critically evaluate and interpret quantitative information rather than accepting it at face value (Geiger, Gal and Graven, 2023). Scholars have noted that statistical data can often convey implicit messages, evoke emotional responses, or be used to manipulate public perception, particularly by those in positions of power (Ackland, 2014; O’Keeffe and Paige, 2019). It has been argued that some individuals selectively employ statistical information that is accessible to themselves but challenging for others to comprehend. Developing critical numeracy enables citizens to scrutinise the claims and statistics presented by policymakers, thereby enhancing accountability and supporting democratic processes. Furthermore, critically numerate individuals are better positioned to question assumptions underlying news reports and statistical claims, correct misinterpretations, generate new insights, and make informed decisions in both personal and societal contexts (O’Keeffe and Paige, 2019). For example, a political report (National Numeracy, 2024) may assert that

unemployment imposes a cost of twenty five billion pound per year on the government while simultaneously portraying claimants in a stigmatizing manner, using terms such as ‘scroungers.’ Critically numerate individuals may be able to interrogate the underlying assumptions of such statistics, considering alternative explanations for unemployment, including redundancy, the prohibitive cost of childcare, or a mismatch between individuals’ qualifications and available employment opportunities (Arshad, Wrigley and Pratt, 2019). By adopting this critical perspective, they may avoid perpetuating misconceptions and discriminatory narratives. This capacity may ultimately foster engagement in social practices oriented toward justice, equality, responsible citizenship and a functioning democracy (Bredberg, 2020).

Student beliefs and dispositions are widely acknowledged to exert a significant influence on both learning outcomes and life trajectories, with negative attitudes representing a substantial barrier to the development of numeracy skills (National Numeracy, 2025). Dweck’s Growth Mindset theory suggests that cognition and understanding are shaped by individuals’ mindsets (Dweck, 2014). Those who demonstrate numerical proficiency and engage in problem-solving, critical thinking, and perseverance in the face of challenges—while interpreting setbacks as opportunities for learning—cultivate both a growth mindset and creative capabilities (Dweck, 2014; Trowbridge, 2024) . In a constantly evolving environment, characterised by unpredictable challenges, these traits may enable individuals to strive for excellence, invest in continuous improvement, and generate innovative solutions. Such capacities are increasingly recognised as essential indicators of employability and future professional success (Trowbridge, 2024).

In essence, numeracy transcends fundamental arithmetic skills to include critical thinking, problem-solving, and the ability to evaluate and utilise numeric information in many circumstances. Its development cultivates practical skills for daily living, financial management, and health, while also promoting social responsibility, equity, and educated civic participation. Furthermore, numeracy fosters a growth mentality and creativity, enabling individuals to adjust to intricate, changing situations and to devise inventive solutions. Numeracy is an essential life skill that supports personal, societal, and professional success, underscoring its persistent significance in education and workforce development; nevertheless, the attainment of advanced numeracy abilities is contingent upon policy, educational frameworks, and societal attitudes.

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Component 2

Blog: What can schools do to encourage numeracy?



Rethinking Numeracy in the Primary Classroom: Time for an honest conversation!

Chantelle Fahey February 2026

How do we truly improve numeracy in the early years? As Wales advances educational reform via the Curriculum for Wales (2021) and the National Numeracy Framework (2013), educators are urged to reevaluate children's initial experiences with mathematics. Nevertheless, in our classes, we continue to witness children who can enumerate numbers but lack confidence, comprehension, or the inclination to embrace risks. This prompts a crucial inquiry for us as practitioners: are the existing reforms truly enhancing numeracy, or must we examine more thoroughly how our views, pedagogical decisions, and classroom practices influence children's initial arithmetic experiences?

Rethinking How Children Construct Numeracy: When Play Becomes Pedagogy

In early years education in Wales, play is recognised as an effective approach for developing numeracy, drawing on the theories of Froebel (1826) and Piaget (1923, cited in MacBlain, 2014). Play-based, experiential learning allows children to explore mathematical concepts such as number, measurement and problem-solving in meaningful contexts, supporting deeper conceptual understanding. This discovery-led approach responds to children's readiness rather than relying solely on direct instruction—but how often do teachers genuinely view play as purposeful mathematical learning?

Hands-on activities using concrete resources, such as blocks, beads and number lines, support mathematical literacy by helping learners connect maths to everyday life. These multi-sensory approaches can strengthen memory and understanding, particularly for pupils with Additional Learning Needs, while also supporting all learners in grasping abstract concepts (Hill, 2024). However, play is sometimes marginalised or treated as a reward rather than a core learning strategy, highlighting the need for a balanced approach that combines child-led exploration with purposeful teacher guidance (Walsh, McMillan and McGuinness, 2017).

Moving beyond MKOs to Meaning: Making Numeracy Social and Inclusive

Social constructivist theory underpins the Curriculum for Wales (2021) approach to numeracy, emphasising collaboration, learner agency and progression. Drawing on Vygotsky (1978), numeracy learning is enhanced through social interaction with More Knowledgeable Others (MKOs), where purposeful questioning and discussion support learners to explain reasoning, explore strategies and develop conceptual understanding rather than simply produce correct answers (Welsh Government, 2022). As Dewey (1910) suggested, meaningful learning requires reflection and abstraction, moving beyond concrete experience to think critically and creatively.

However, classroom questioning often prioritises recall over reasoning, limiting opportunities for deeper understanding (Thompson, 2010). Higher-order questioning, though more time-consuming, enables teachers to listen for learners' thinking and identify misconceptions, supporting the development of critical numeracy (Thompson, 2010). Teaching numeracy through real-life contexts further strengthens relevance, allowing learners to analyse issues, consider different viewpoints and apply mathematics meaningfully.

Despite this inclusive vision, ability grouping in mathematics remains common and can restrict access to MKOs, reinforce fixed ability beliefs and contribute to maths anxiety (Boaler, 2016). Such practices conflict with the Curriculum for Wales commitment to equity and high expectations for all, highlighting the need to reconsider how numeracy is organised to promote socially just and inclusive learning.

From Fear to Flourishing: Addressing Attitudes in Numeracy and mathematics

Negative attitudes towards mathematics, particularly maths anxiety, can limit working memory, reduce confidence, and lower performance in numeracy. In the UK, around 50% of adults have low numeracy skills, (National Numeracy, 2024) and research suggests that parents' own anxiety or negative experiences with maths can influence their children's attitudes (Loughborough University, 2025). In the classroom, fostering a growth mindset (Dweck, 2014)—normalising mistakes and encouraging persistence—alongside high expectations via the Pygmalion effect (G, 2013) can motivate learners and enhance achievement. If beliefs and expectations shape numeracy outcomes so strongly, should improving numeracy start with changing how we think about learning and who can succeed in mathematics?

Beyond Right and Wrong: Shifting Focus from Testing to Thinking

Assessment for learning (AfL) offers a means to develop numeracy beyond the narrow confines of testing, yet policy often prioritises speed, memorisation, and measurable outcomes (Boaler, 2016). When success is defined by correct answers alone, students may excel in exams but fail to develop reasoning, problem-solving, or conceptual understanding (Munn, 2005). Should assessment serve accountability or genuinely support learning? AfL emphasises formative strategies—observation, dialogue, feedback and co-construction of knowledge—allowing teachers to identify what learners can achieve with guidance, rather than what they already know (Vygotsky, 1978; Black and William, 1998). By focusing on the learning process rather than the product, AfL encourages independence, critical thinking, and engagement. Objective, repeated observation across tasks and contexts is essential to avoid bias and account for variability in behaviour and understanding, while also resisting the limitations of checklists or one-off assessments (Papatheodorou, Luff and Gill, 2013). In doing so, AfL positions numeracy as a developmental, meaningful skill rather than a performance metric.

Creating Competent Numerical Mathematicians or just tick-box learners?

The Welsh Curriculum (2021) actively promotes numeracy as a cross-curricular skill, recognising that mathematical understanding underpins learning in subjects such as science, technology, geography, and design. This integrated approach allows learners to make connections between disciplines, apply numerical reasoning in real-world contexts, and develop creativity by seeing how maths informs other areas of knowledge (Fox and Surtees, 2010). The Welsh Numeracy Framework (2013) supports teachers with structured guidance on lesson planning, emphasising four strands: numerical reasoning, number skills, measurement, and data, aiming to prepare students for lifelong numeracy and future prosperity.

However, the framework has been criticised for prioritising breadth over depth, with progression steps that can appear uneven and “I can” statements that may unintentionally demotivate learners if perceived as rigid benchmarks rather than developmental guidance (Priestley and Biesta, 2013; Torrance, 2015). Cross-curricular numeracy also relies heavily on teacher confidence and expertise; where educators lack confidence or experience anxiety around mathematics, implementation may be inconsistent, limiting the potential for meaningful engagement (Ramirez et al., 2018). Critics argue that low standards in numeracy often reflect pedagogical weaknesses rather than student ability (Lewis, 2025), raising the question: are we cultivating genuinely skilled numerate citizens, or merely producing learners who achieve basic competence through a process that disengages and frustrates them? Encouraging numeracy, therefore requires not only robust frameworks but also ongoing professional development, reflective teaching, and classroom practices that make mathematics relevant, engaging, and empowering (Thompson, 2010; Fox and Surtees, 2010).



(Artlist,
2026)

Numeracy is not just taught—it is experienced. So, we must ask ourselves: are we creating mathematicians, or merely students who follow procedures? It's time to rethink Numeracy! The country's prosperity lies in our hands.

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Component 3

Resource information sheet for professionals
about a numeracy resource of your choice which
aims to support numeracy development in pupils
with ALN



Mathlink Cubes

A Numeracy Resource Information Sheet

Overview

Mathlink cubes are physical tools that support early numeracy, allowing students to explore numbers, operations, and patterns through engaging play. They make abstract concepts visible and tangible, allowing learners to develop, deconstruct, and model mathematical ideas (EEF, 2016). Bruner's (1966) theory of representation highlights how they facilitate the transition from enactive (hands-on) understanding to iconic (visual) and symbolic (abstract) comprehension (Iyamuremye and Burns, 2025). Mathlink cubes may develop key skills such as counting, problem-solving, spatial reasoning, pattern recognition, creativity, perseverance, and collaborative learning through shared exploration (Bird, 2023; Coker, 2025).

Targeted Students

- ✔ Mathlink cubes are suitable for learners aged 4–11 and support the development of foundational numeracy as well as more advanced concepts, including early algebra (Hill, 2024).
- ✗ They are particularly effective for learners with diverse needs, such as dyscalculia, MLD, and ASD, as their multi-sensory, hands-on nature helps break learning into manageable steps and build on prior knowledge (Paolillo, 2025; Morin, 2024). This concrete approach may improve understanding, memory, and retention, especially for those with processing difficulties (McNeil and Jarvin, 2007)
- When combined with strategies such as scaffolding, questioning, collaboration, and formative assessment, within a playful approach Mathlink cubes may promote positive attitudes, resilience, and social awareness, addressing barriers related to maths anxiety and stigma (Molyneux and Diamond, 2025) .
- ✚ Mastery of early mathematical concepts forms the basis for developing critical numeracy and quantitative literacy, key competencies for informed participation and future prosperity (National Numeracy, 2024).

Assessment and Progression

Mathlink cubes are an effective resource for enhancing and investigating numeracy concepts in line with the Welsh Government Numeracy Framework. They encompass all four areas: developing numerical reasoning, using number skills, using measuring skills, and using data skills through practical, hands-on experiences. Practitioners can evaluate understanding and track progress by observing learners as they manipulate the cubes. The framework assists educators in designing impactful lessons and a structured curriculum, promoting advancement in numeracy. This is designed to aid teaching and support assessment for learning, rather than serve as an independent measure for summative evaluations of learners' progress and achievement (Welsh Government, 2021; 2020)

Putting it all together

Task	Numeracy Framework Strands	Development of Numeracy Skills and wider skills	Assessment and measuring progress: Example
Counting and grouping cubes (2s, 5s, 10s)	Using number skills – develops grouping, counting sequences, multiplicative reasoning, and place value.	Conceptual number understanding, pattern recognition, fluency, early multiplicative reasoning.	AFL questioning: “How do you know there are 20 without counting individually?” Progress shown when pupils group efficiently and count in multiples rather than recounting.
Building towers (small, tall, large)	Using measuring skills – develops awareness of height, length, area, and volume using non-standard units.	Spatial awareness, estimation, comparison, reasoning, mathematical language, creativity, and resilience.	AFL questioning: “How many cubes taller?” “How do you know it is bigger?” Progress shown through accurate comparisons and clear reasoning (height vs volume).
Stacking cubes to create bar graphs	Using data skills – collecting, representing, and interpreting data concretely.	Communication, reasoning, comparison, data interpretation, pattern recognition, critical thinking.	AFL questioning: “Which is most? How do you know?” Progress shown when pupils explain differences, interpret trends, and verify totals independently.
Problem solving part-whole number bonds (make 10)	Using number skills and numerical reasoning – supports partitioning, additive reasoning, and strategy use.	Conceptual understanding, flexible thinking, problem solving, fluency, collaboration, resilience.	AFL questioning: “Is this the only way?” Progress shown when pupils generate multiple combinations, check independently, and explain reasoning verbally and symbolically.

(Welsh Government, 2020; 2021; Fahey, 2026)

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Component 4

Video of the resource in action

Link to Numeracy Video

[Mathlink Numeracy Video.pptx](#)

Component 5

Evaluation of the resource

Evaluation of the resource

Mathlink Cubes are interconnecting plastic manipulatives intended to facilitate the representation of abstract mathematical concepts through physical fabrication. By interlinking several surfaces, they allow learners to create towers, arrays, and three-dimensional structures that promote the discovery of counting, place value, number bonds, patterns, and fundamental algebraic reasoning. Their principal role is to connect tangible experience with abstract reasoning, enabling children to actively alter and visualise numerical relationships (Gnawali, 2025). This assignment will critically evaluate the effectiveness of the resource from a pedagogical, theoretical and political perspective.

The pedagogical rationale for Mathlink Cubes is intricately linked to constructivist theory. Jean Piaget (1952) asserted that students actively construct knowledge through interaction with their surroundings. The manipulation of cubes allows learners to explore, test hypotheses, and modify their thinking, facilitating the assimilation and accommodation of new mathematical concepts before the emergence of abstract reasoning. Furthermore, the utilisation of Mathlink Cubes corresponds with Jerome Bruner's (1966) Concrete–Representational–Abstract (CRA) framework, which posits that learning advances through enactive (tactile experience), iconic (visual representation), and ultimately symbolic (abstract notation) stages. When applied consistently within the CRA framework, manipulatives can alleviate cognitive load and enhance conceptual comprehension rather than mere procedural memory. Active manipulation is linked to the enhancement of neuronal circuits, therefore facilitating memory consolidation, retrieval and fluency (Barnes, 2015). This multisensory approach is particularly advantageous for learners

with Additional Learning Needs (ALN), particularly those with processing or language difficulties, as manipulatives can facilitate comprehension by deconstructing complicated concepts into tangible, accessible representations (Paolillo, 2025). Students with restricted fine motor skills or diminished dexterity may face difficulties in manipulating or separating the cubes, which could hinder autonomous participation (Yip, 2021). The playful characteristics of the cubes may augment engagement and intrinsic motivation, cultivating a positive mathematical disposition and potentially alleviating mathematics anxiety. Nonetheless, in the absence of specific teacher instruction, learners may perceive them as toys, resulting in off-task behaviour (Fulmer, 2017). Educators may erroneously equate active participation with comprehensive learning, when such engagement could be superficial and devoid of conceptual depth (Furner and Worrell, 2017). Moreover, some learners with Additional Learning Needs (ALN), may have difficulties associated with dual representation. They may regard the cubes merely as tangible objects instead of symbolic representations, which can hinder the cultivation of abstract comprehension, if their purpose is not made explicit (McNeil and Jarvin, 2007). Additionally, prolonged reliance may foster dependency, hindering transfer to abstract contexts (Fulmer, 2017).

Utilising Mathlink Cubes for counting tasks may enhance cardinality, numerical relationships, and overall numerical comprehension (Akther, Powell and Lariviere, 2025). Physically organising cubes into sets promotes the comprehension that the final count signifies the overall quantity, so fostering robust numeric foundations and potentially alleviating cognitive load in more advanced mathematics. Furthermore, the creation of three-dimensional models may enhance spatial vision

and reasoning skills, which are closely linked to future mathematical success and involvement in STEM disciplines (Verdine et al., 2014). Spatial reasoning is fundamental to creativity, problem-solving, perseverance, and innovation, with activities including tower construction, symmetry exploration, and array formation exemplifying approaches used in engineering and construction. Nonetheless, these extensive advantages may only be actualised when educational links are clearly articulated; if manipulatives are confined to procedural arithmetic tasks, their transdisciplinary potential may remain unfulfilled (Furner and Worrell, 2017).

The efficacy of Mathlink Cubes may depend on purposeful pedagogical facilitation. Lev Vygotsky's sociocultural theory highlights the significance of scaffolding within the Zone of Proximal Development (1978), asserting that advanced cognitive processes emerge through facilitated social interaction. By employing strategic questioning, modelling, and dialogic instruction, manipulatives can enhance learners' reasoning beyond their own capacity (Kyriacou, 2009). Enquiries that necessitate justification and alternative representations, such as examining equivalence or various formulations of a quantity, may transition the emphasis from procedural counting to adaptable, conceptual comprehension.

Such discussions serve as a formative assessment. Meticulous observation of how learners formulate, modify, and elucidate their models can uncover misconceptions; for instance, dependence on counting instead of acknowledging part-whole relationships (Black and Wiliam, 1998). This methodology is consistent with the guidelines of the Welsh Government numeracy framework (2021) which emphasises reasoning, problem-solving, and conceptual advancement rather than

just procedural proficiency. The manipulation of Mathlink Cubes and the co-construction of knowledge can support the development of skills and understanding across multiple curricular areas, allowing students to make connections and consider perspectives from different domains (Barnes, 2015). However, as primarily a mathematical resource, their potential to enhance learning in other subjects may be underrecognised or underutilised by teachers (Furner and Worrell, 2017).

The incorporation of cubes in structured mathematics games can further increase participation and foster broader competencies such as communication, teamwork, creativity, and resilience in facing challenges (James Anthony Russo et al., 2024). Collaborative problem-solving fosters perspective-taking and social cohesion, facilitating the advancement of higher-order thinking vital for critical numeracy. The Successful Futures study (Donaldson, 2015) underscores the significance of cultivating skills through both adult-directed and child-initiated, play-based activities, supporting a curriculum that promotes holistic learning, creativity, and active participation, which further supports the UNCRC (1989) by ensuring children's voices are heard.

Research indicates that numeracy encompasses not just fundamental calculations but also data interpretation, critical assessment of statistical assertions, and the application of mathematics to societal and global challenges (Ackland, 2014; O'Keeffe and Paige, 2019)). In numerous classrooms, Mathlink Cubes are primarily employed to emphasise fundamental abilities, such as number bonds, which may unintentionally restrict students' mathematical experiences and hinder the development of critical thinking. Evidence suggests that even young learners may effectively engage with social justice topics; encompassing

environmental, political, and social issues (Atha, 2025), suggesting that manipulatives may facilitate critical numeracy rather than merely basic abilities. This potential may be constrained by educators' confidence, topic expertise, or ambiguity in incorporating cubes into wider problem-solving scenarios (Geiger, Gal and Graven, 2023). When effectively integrated into dialogue, real-world tasks, and interdisciplinary learning such as in science, design technology, or geography, Mathlink Cubes can augment conceptual understanding, facilitate skill transfer, and foster the development of critical, and comprehensive numeracy.

In conclusion, Mathlink Cubes offer a concrete connection to abstract mathematical concepts, enhancing numerical comprehension, spatial reasoning, and higher cognitive abilities. Their effectiveness may rely on deliberate teacher instruction, confidence, and topic proficiency. When incorporated into discourse, practical problem-solving, and interdisciplinary learning, Mathlink cubes may augment critical numeracy, creativity, and collaboration, which are essential lifelong skills, thereby supporting the Welsh core purposes. In the absence of rigorous instruction, their implementation may remain superficial, limiting conceptual understanding and reducing broader educational benefits.

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