

# Establishing an International Comparative Framework for Design and Technology Education: A Multi-Jurisdiction Curriculum Analysis Methodology

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## *Abstract*

Design and technology (D&T) education reflects diverse educational purposes across jurisdictions, variously emphasised as engineering and technology education, vocational preparation, or general education. Yet curriculum developments often occur in isolation, with limited systematic comparative analysis. This paper presents the methodological framework for the initial documentary analysis phase of a multi-year international comparative project examining D&T curricula across 18 jurisdictions.

The project adapts the Umalusi curriculum benchmarking framework—originally developed by South Africa's Council for Quality Assurance for international curriculum comparison—for systematic documentary analysis. This validated framework provides rigorous analytical instruments while allowing flexibility across diverse cultural contexts. The methodology focuses on D&T within general (non-elective) lower secondary education (approximately ages 11–14) in jurisdictions with published national curricula.

Analysis encompasses eight core dimensions: curriculum design and format; aims and philosophical orientation; content coverage and breadth; time allocation and pacing; cognitive depth; curriculum integration; pedagogical guidance and assessment frameworks; and contemporary elements. Data collection uses an online survey integrating Likert scale items, open responses and document uploads, supported by Excel based analysis templates. A secure SharePoint workspace enables shared document storage and distributed ethical governance across participating institutions.

The methodology's key contribution lies in establishing a replicable, validated framework for international curriculum comparison in D&T education. It supports the participation of additional jurisdictions in subsequent project phases while offering a reusable structure for future independent studies. By adapting a proven benchmarking instrument, this approach provides baseline comparative data essential for evidence-informed curriculum review and policy development, while building

sustainable international research capacity through collaborative analysis and knowledge exchange among teacher educators and early-career researchers.

*Key Words: Comparative Education, Curriculum Analysis, Design and Technology Education, International Benchmarking, Documentary Analysis*

## 1 INTRODUCTION

Design and technology (D&T) education reflects diverse educational purposes across jurisdictions globally, variously emphasised as engineering and technology education, vocational preparation, or general education. Yet curriculum developments often occur in isolation, with limited systematic comparative analysis (Bray et al., 2014). Existing global measures such as PISA do not include D&T, focussing instead on core subjects (OECD, 2019), and available datasets are too coarse to offer subject-level insight into design and technology curricula or their practical requirements (OECD, 2023). While bilateral collaborations and professional networks exist, there remains a lack of systematic, subject-specific frameworks for international comparison of intended design and technology curricula. This highlights the need for a structured method for comparing D&T curricula internationally.

The scope of the project is design and technology education within general education (not elective) at lower secondary level, typically for learners aged 11-14, in jurisdictions with published national curricula. The methodological framework described in this paper is used in Phase 1a of the multi-year International Design and Technology Education Comparative Research Project. This wider project comprises three phases: (i) curriculum analysis and comparison, including intended, enacted and hidden curricula and sub-foci such as curriculum ideology, underpinning values, entrepreneurship and 21st-century skills; (ii) teacher preparation; and (iii) contextual issues. This paper reports on the first step of Phase 1a, focusing specifically on the intended curriculum.

To support systematic comparative analysis, the project adapts the Umalusi curriculum benchmarking framework, originally developed by South Africa's Council for Quality Assurance for international curriculum comparison (Umalusi, 2015). Using this adaptation, we present in this paper a methodological framework for documentary analysis of intended D&T curricula across multiple jurisdictions.

The paper is structured in five parts. First, we outline the benefits of comparative education and limitations of global measures for D&T. We then provide an explanation of the Umalusi curriculum benchmarking framework. The main section of the paper describes each dimension of the adapted analytical framework. This is followed by an update on the project's progress and, finally, a discussion of the anticipated contribution of Phase 1a.

This paper therefore addresses the following research question:

How can a validated international benchmarking framework be adapted to enable systematic, rigorous comparison of intended design and technology curricula across diverse jurisdictions?

## **2 COMPARATIVE STUDIES OF EDUCATION SYSTEMS**

Comparative studies of education examine how different jurisdictions organise curriculum, schooling, learning and related policies, shaped by context, cultural and economic considerations (Bray et al., 2014). Comparative studies help researchers and policy writers to identify how other curriculum content is structured, what their aims are, and how they are organised (Marshall, 2024). This can identify similarities, differences, priorities and assumptions. It highlights good practice, reveals gaps and informs education policy. However, it must be sensitive to oversimplification and uncritical adoption in different contexts (Bray et al., 2014).

Global comparative measures tend to emphasise core domains such as literacy, numeracy and, increasingly, digital competence, which are seen as foundational indicators of system performance (OECD, 2019). Major comparative programmes such as PISA focus primarily on these core subjects, with creativity assessed only when jurisdictions opt into additional testing cycles; for example, PISA measured creative thinking for the first time in 2022, but participation was optional and coverage variable (OECD, 2024). Even where creativity data exist, they remain centred on broad cognitive processes rather than subject-specific capabilities such as design and technology. Although the OECD has undertaken analyses of instructional time across secondary education systems, these datasets are too coarse to offer subject-level insight into design and technology curricula or their practical requirements (OECD, 2024). Systematic international comparisons specific to D&T remain limited, with most available literature emerging from individual jurisdictions for research or teacher-facing purposes (Banks & Williams, 2022) rather than large-scale cross-national studies. In some cases, national curriculum reviews have compared subjects through the lens of “knowledge-rich” models; for example, work in Northern Ireland suggested that D&T appeared less knowledge-heavy than subjects in some high-performing jurisdictions (Nijluning et al., 2025). This raises questions about whether D&T is marginalised because it is undervalued, unmeasured in comparative studies, or simply misaligned with the narrow parameters used in such reviews.

These gaps underline the need for a structured comparative framework that can capture the distinctive features of D&T curricula, which we address through our adaptation of the Umalusi curriculum benchmarking framework (Umalusi, 2015).

## **3 UMALUSI CURRICULUM BENCHMARKING FRAMEWORK**

Umalusi is South Africa’s quality assurance body in general and further education. It is responsible for ensuring the standards of the South African curriculum (the Curriculum and Assessment Policy Statements, CAPS). Umalusi (2015) created a multi-dimensional analysis framework to enable evaluators to compare CAPS with international qualifications in a structured, consistent way. They wanted evidence to support national conversations about curriculum reform

drawing on international comparisons of curriculum design, content breadth and depth, pacing, progression, pedagogy, assessment, and integration. Umalusi designed the framework to be repeatable across multiple subjects (Du Toit & Gaotlhobogwe, 2017a; Du Toit, 2021; Umalusi, 2018). The framework has been used to compare technology curricula in Botswana and South Africa (Du Toit & Gaotlhobogwe, 2017b) and consumer studies curricula in Botswana, Eswatini, Lesotho, Namibia and South Africa (Du Toit, 2021). We have adopted the Umalusi curriculum benchmarking framework for this project because it is adaptable internationally, has been validated through multiple subject applications, and provides a comprehensive set of dimensions for systematic curriculum comparison.

## **4 FRAMEWORK FOR COMPARATIVE ANALYSIS OF DESIGN AND TECHNOLOGY EDUCATION**

This section describes the dimensions of the benchmarking framework for analysing the published curricula in each participating jurisdiction. The framework is an adaptation of the Umalusi curriculum benchmarking framework tailored to compare published D&T curriculum. The analysis uses a JISC online survey for dimensions 1-4 and 6-8 and an Excel-based analysis template to collect each jurisdiction's analysis of their own documentation (content depth - dimension 5). The online survey includes Likert-scale items, categorical questions, and open responses, and facilitates uploading relevant curriculum documents. The Excel template collects details of specific topics in the curriculum with a corresponding rating of cognitive complexity. Curriculum documents are uploaded to a SharePoint site to maintain a central, accessible record of all files for future reference. This approach helps establish transparency, document provenance, and national context for comparing the data analysis. Together, these eight dimensions and the associate analysis enable a systematic and rigorous comparison of international D&T curricula.

It should be noted that the framework does not seek to normalise or resolve differences in national subject traditions. Instead, it is designed to make such differences visible through analysis of intended curriculum documentation, allowing variation in purposes, emphases and structures of design and technology education to be systematically identified and compared.

### **4.1 Curriculum Design and Format**

In the first section, we are examining the overall design principles and format of the curriculum documents. This will capture how the curriculum is organised, what design principles guide its structure, and how accessible the documentation may be for teachers. This is identified by analysing its "user-friendliness" and the accessibility of language. For some government websites there is a requirement for this that is determined by the reading age of the documents [ref gove.co.uk website]. The design principles focus on the driver for the curriculum design, including whether the curriculum is content, skills, outcomes or competency based or if there is a balance between content and skills. The final question in this section records how well different curriculum documents work together as a coherent set. For example, whether terminology is consistent across all documents.

## **4.2 Curriculum Objectives**

Next, we analyse the subject aims whether stated or implied - or if there are any. Where there are aims, we are comparing the aims of each curriculum with common international themes in design and technology education to understand the curriculum's philosophical orientation. These themes include (but are not limited to) developing technological literacy, creative thinking, develop 21st century skills (collaboration, communication, etc.), knowledge-rich, and offer authentic problem-solving opportunities.

## **4.3 Content Coverage and Breadth**

This section examines what content areas and topics are included in each curriculum and how they are distributed across different year groups. We want to understand what content and skills are specified, how they are organised, and how extensively different areas are covered. The subject content knowledge is specific to design and technology, for example, structures, mechanisms, food, textiles and so on. The skills topics are subject-specific (design skills, making skills) and generic skills that may be relevant to other school subjects (critical thinking and problem-solving skills).

## **4.4 Time Allocation and Pacing**

This dimension examines how teaching time for design and technology is specified and organised within the curriculum. We record whether formal allocation of time is specified, and if it is, we capture the teaching hours per week and per annum. If no time is stipulated, this absence is noted as part of the comparative analysis, as it reflects the level of autonomy given to schools. In addition to total teaching time, the questionnaire captures whether the curriculum requires extended or uninterrupted practical lessons—such as double periods or block sessions—to support workshop-based activities. These details help us understand the pacing expectations placed on teachers and whether the curriculum acknowledges the practical nature of design and technology.

## **4.5 Content Depth and Specification**

Here the analysis uses a systematic approach using a template to examine how deeply content is treated and how clearly it may be specified for teachers. We are interested in understanding the cognitive demands the curriculum places on learners, how clearly content is defined - if at all, and whether there may be evidence of progression in complexity within and across year groups. Although the cognitive depth scale resonates with established learning taxonomies (e.g. Bloom), it was developed as a bespoke analytical tool for curriculum document analysis rather than as an instructional or assessment taxonomy. This is done by analysing each component of the curriculum content in turn using a four-point scale:

- (i) Introductory level: superficial treatment, mainly definitions and descriptions or no real understanding expected (e.g. Name three types of structures)

- (ii) Basic understanding: definitions with some detail, requires basic level of understanding or simple relationships between concepts (e.g. Describe how gears work)
- (iii) Detailed knowledge: requires detailed knowledge of concepts, deep understanding of concepts or understanding relationships between concepts (e.g. design a stable structure for given constraints).
- (iv) Complex understanding: conceptually challenging treatment, complex understanding of relationships and or application in novel/challenging contexts (e.g. analyse structural failure and propose solutions).

#### **4.6 *Integration and Connections***

In this dimension we are capturing detail about how the curriculum makes connections. We ask about three different types of connection: first, connections within the D&T curriculum; next, connections made with other subjects and finally connections with pupils' experiences outside school and future careers. The level of explicitness may vary between curricula and may not be mentioned at all – this is also captured in the survey. This reveals how the curriculum is oriented, whether it is isolated, interdisciplinary, or experiential.

#### **4.7 *Pedagogical Approach and Assessment***

This dimension examines the extent to which the curriculum provides explicit guidance on teaching approaches and assessment in design and technology. Its purpose is to identify how clearly teachers are directed in the pedagogical practice they are expected to use. This includes whether the curriculum specifies approaches such as project-, design-, inquiry- or content-based learning, and where guidance is provided, how detailed or prescriptive that guidance is. Similarly, whether specific assessment methods are required - such as portfolio, practical or written assessment - and whether pupils are expected to engage in peer or self-assessment. Finally, it considers how prescriptive the assessment guidance is overall, noting whether they allow for local adaptation.

#### **4.8 *Contemporary Elements and Context***

The final dimension captures whether the curriculum explicitly mentions contemporary issues and contextual factors. Curricula may vary in how they incorporate current global challenges, emerging technologies, cultural considerations, and societal issues. Some curricula may explicitly feature topics such as sustainability, digital technologies, or entrepreneurship, whilst others may mention these themes briefly, or may not address them at all. This helps us understand how different educational systems respond to current challenges and opportunities in design and technology education.

### **5 INTERNATIONAL COMPARATIVE PROJECT**

The project began in July 2025 with recruitment of 17 jurisdictions: Asia–Pacific (Australia, New Zealand, South Korea, Japan); Europe (UK, Ireland, Finland, Sweden); Latin America

(Argentina, Chile) and Southern Africa (South Africa, Botswana, Namibia, Zimbabwe, Lesotho, Eswatini). Each jurisdiction has a lead representative who has experience of conducting research and has an interest in a comparative project. These representatives also have knowledge of teacher education, which will be relevant for later phases of the project. The framework is being applied to published national or jurisdictional curricula for lower secondary pupils, commonly aged between 11 and 14 years.

Collaboration agreements have been established, with a Memorandum of Understanding (MoU) in place. All institutions have obtained ethical approval and have uploaded evidence of this to the central project SharePoint site. Nottingham Trent University is the lead institution; although ethical clearance is not strictly necessary for documentary analysis, approval has been secured as a foundation for consistent project governance. All participating jurisdictions have been required to complete ethical approval and sign the MoU before beginning the data analysis.

As noted earlier, data analysis is conducted using a JISC survey and an Excel spreadsheet, ensuring a consistent approach that supports transparency and repeatability. All curriculum documents are uploaded to the project SharePoint site, along with the completed JISC and Excel analyses, to create a traceable and auditable record. We have encouraged jurisdiction leads to work with teachers and teacher educators to double-code the curricula to support reliability. We also view this as an opportunity to involve, and thereby strengthen, the international D&T research community.

Alongside the data analysis, we are sharing our project design with government organisations, such as departments or ministries of education, and international bodies, such as OECD. These organisations have expressed interest, and we will share findings as the project progresses. Now that a clear process has been established for adding new jurisdictions, we are open to expanding the comparative project. We anticipate refining the framework further as the project develops and more jurisdictions participate.

## **6 CONTRIBUTION**

This international collaborative research project is the first comprehensive comparative analysis of design and technology education curricula across multiple jurisdictions, focusing on learners in lower secondary school where the subject is part of a compulsory education within general education contexts (to our knowledge; cf. Jones et al., 2013). The project addresses the gaps mentioned earlier in comparative education: the global focus on literacy, numeracy and digital skills, and the limited nuance within existing international measures. The findings from the intended curriculum analysis (Phase 1a) offer ministries and curriculum agencies a structured lens for reviewing breadth, depth, progression and assessment, supporting more evidence-informed curriculum reviews (Bray et al., 2014).

For the research and teacher education communities, the framework establishes shared terminology and analytical categories, easing collaboration across jurisdictions and helping address assumptions or oversimplified adoption of D&T curricula, pedagogy and assessment. It

builds capacity for collaborative analysis and supports international knowledge exchange in the D&T education research community.

Built on established partnerships between the UK and South Africa, the project has expanded to 17 jurisdictions across Europe, Asia-Pacific, Africa and the Americas. This broad participation strengthens the international relevance of the framework and positions the work as a foundational contribution to future comparative studies in design and technology education.

## 7 AI DISCLOSURE STATEMENT

Artificial Intelligence (AI) technologies were used solely to enhance clarity and structure of the written text. All scholarly contributions, theoretical perspectives, and analyses were produced by the authors.

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