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A Scoping Review of Educational Time, Pace, and Learning Design as Pedagogical Constructs

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Abstract. This scoping review examines how educational research has conceptualised time, not as a neutral container in which learning happens, but as a pedagogical construct that is designed, distributed and experienced. Its purpose is to map the concepts, theories and evidence through which scholars have treated educational time across a century of scholarship, and to identify what this mapping implies for learning design. The review follows the framework of Arksey and O'Malley, as refined by Levac and colleagues and the Joanna Briggs Institute guidance, and is reported in line with the PRISMA extension for scoping reviews. Structured searches across eight thematic strands returned 154 records, of which 35 sources were charted and synthesised, spanning classic models of school learning, causal studies of instructional time, sociology of educational temporality, competency based progression and digital self pacing. The results show that the field works with at least five families of constructs: time as quantity allocated and engaged, time as the ratio between time spent and time needed, time as an institutional and cultural order, time as pace and acceleration, and time as a designable variable in mastery based and digital learning. Across these families, pace emerges as a hidden equity variable, because uniform pacing converts differences in time needed into differences in achievement. The novelty of this review lies in assembling these separated literatures into a single synthesis map and in deriving design principles that treat time pedagogically rather than administratively, so that time becomes an explicit object of curriculum judgement instead of an inherited constraint.
Keywords: educational time; pace; instructional time; academic learning time; learning design; scoping review

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INTRODUCTION

Every school day begins with an act of temporal faith. Bells divide the morning into periods, terms divide the year, and age cohorts divide childhood itself, and within these divisions teachers and students are expected to make learning happen. The divisions feel natural, almost physical, yet they are neither. The clock time that governs schooling is a historical achievement, and its classic historian showed that the movement from task oriented time, in which work lasted as long as the task required, to timed labour, in which the clock itself became the measure and the discipline, was one of the deepest cultural transformations of industrial capitalism [1]. Schools were among the institutions through which this transformation was taught to children, and the habits of clock time, punctuality, sequencing and synchronisation became part of what schooling silently certifies. To study educational time is therefore to study something that education both uses and produces.

Sociology has long insisted that clock and calendar time are only the visible surface of social time. Beneath them lie rhythms, tempos, durations and timescapes that are embedded in bodies, institutions and environments, and that differ between the time of the timetable and the time of the learner who must live inside it [2]. Critical theory adds that modern societies are organised by acceleration, a structural compulsion to speed up technological change, social change and the pace of life itself, so that institutions must continually grow and innovate simply to maintain their position [3]. Education sits directly in the path of this compulsion. Curricula accumulate content, accountability cycles shorten, and digital platforms promise learning that is faster, continuous and available at any hour, while the developmental time of children refuses to accelerate at the same rate.

Against this background, the psychology of school learning produced a strikingly different claim. In 1963 Carroll proposed that the degree of learning is a function of the time a learner actually spends learning divided by the time that learner needs, and he redefined aptitude itself as the amount of time a student requires to learn a task under favourable conditions [4]. The claim inverted the moral economy of schooling. If aptitude is time needed, then failure is often a mismatch between time supplied and time required, and the apparently neutral decision to give every learner the same amount of time becomes the mechanism that manufactures differences in attainment. Bloom drew the organisational conclusion in his account of learning for mastery, arguing that if time is allowed to vary while expectations are held constant, most students can reach levels of achievement that conventional fixed time instruction reserves for a minority [5]. The Beginning Teacher Evaluation Study and the work that followed it decomposed classroom time into allocated time, engaged time and academic learning time, showing that only a fraction of the time on the official timetable becomes successful learning time for any given student [6].

These traditions have rarely been read together. Reviews of extended school time ask whether more hours raise test scores and find modest average effects that depend heavily on how added time is used [7], while recent syntheses reframe the question entirely, treating time in school as a multidimensional resource whose scheduled, instructional and experienced forms must be distinguished before any causal claim makes sense [8]. Meanwhile the sociology of education has begun to argue that temporality itself has been a neglected dimension of the field, crowded out by attention to space, and that globalisation and digitalisation have multiplied the temporalities that policy and practice must negotiate. What is missing is a map that shows how these literatures define time, what each definition makes visible, and what each conceals. This paper supplies that map through a scoping review, and it pursues three questions. How has educational scholarship conceptualised time, pace and duration in relation to learning? What does the mapped evidence show about time as an equity variable? And what design principles follow if time is treated as a pedagogical construct, open to deliberate design, rather than as an administrative given?

METHODS

This review is a scoping review, chosen because the object of inquiry is a concept distributed across several disciplines rather than an intervention with a measurable effect. It follows the six stage framework proposed by Arksey and O'Malley, identifying the research question, identifying relevant studies, selecting studies, charting the data,

collating and reporting the results, and treating consultation as an optional final stage [9]. The refinements proposed by Levac and colleagues were applied throughout, in particular the insistence that the purpose and the question be linked explicitly, that study selection proceed iteratively, and that the collation stage combine a numerical summary with qualitative thematic analysis [10]. The updated Joanna Briggs Institute guidance supplied the operational structure, including the Population, Concept and Context formulation of the review question [11]. In this review the population is learners and teachers in formal and digitally mediated education, the concept is educational time in its forms of duration, allocation, engagement, pace and temporality, and the context is schooling and organised learning from primary education to professional training. Reporting follows the logic of the PRISMA extension for scoping reviews, with its emphasis on transparent accounts of sources, selection and charting [12], and the conduct of the review team work reflects published experience of applying the framework in large interdisciplinary teams [13].

The identification stage used structured searches across eight thematic strands: time and learning in the classic models; academic learning time; pace and pacing; mastery learning and time; length of the school day and year; timetabling and intended instructional time; slow education and slow scholarship; and time in digital and self paced learning. Twenty four search runs were executed, combining construct terms such as instructional time, academic learning time, time needed and social acceleration with context terms such as schooling, curriculum and learning design. The searches returned 154 records in total. Records were deduplicated across strands, and clearly off topic material, including commercial study aids, timetabling software promotion and news items without scholarly content, was removed, leaving 96 records for title screening. Title and abstract screening against the Population, Concept and Context criteria excluded 52 records, most often because time appeared only as a background variable in an effectiveness study or because scheduling was treated purely as an operations research problem. Forty four sources were then assessed in detail through full text or extended publisher and repository records. Nine were excluded at this stage, principally duplicate editions of the same work, sources whose bibliographic details could not be verified, and studies of calendar reform that reported no conceptual or empirical treatment of learning time. The final charted set comprises 35 sources, which form the reference list of this paper.

Each included source was charted on a common set of fields: the construct of time it advances, whether time is treated as allocated, engaged, needed, experienced or designed, the educational level and setting, the type of evidence or argument, and the implication the source carries for equity and for learning design. Consistent with scoping review convention, no formal quality appraisal was undertaken, because the purpose is to map the range and nature of the conceptual field rather than to pool effects. The synthesis proceeded in two movements. First, the charted constructs were clustered into families according to how each source defines the relation between time and learning. Second, the families were read against one another to identify agreements, tensions and blind spots, and to derive design principles. The results of the charting and the thematic synthesis are presented together in the following section, as the template of this journal requires, with the numerical summary of the search reported here and the full search log preserved in the accompanying evidence file.

RESULT AND DISCUSSION

1. Three quantities of time: allocated, engaged and experienced

The first family of constructs in the charted literature distinguishes quantities that ordinary language collapses into one word. Allocated time is the time institutions provide, expressed in school years, days, periods and minutes, and it is the only quantity that policy directly controls. The classroom research tradition showed how quickly this quantity leaks. In the Beginning Teacher Evaluation Study, observers separated the time allocated to a subject from the time students were actually engaged with it, and then isolated within engaged time the narrower band in which students worked on material closely related to valued outcomes and experienced a high rate of success, which the researchers named academic learning time [14]. The proportions were sobering. Engagement rates varied widely between classrooms teaching the same allocated curriculum, and successful engagement varied more widely still, so that two students sitting through an identical timetable could accumulate very different amounts of the only kind of time that predicts achievement. Berliner's later reflection on this programme insisted that instructional time should be treated as a serious scientific construct, a family of related concepts rather than a single variable, and warned against the fuss and the fudge that surround its public discussion [6].

The experimental work of Gettinger converted the distinction into a ratio with consequences. When learners were allocated fewer trials than they needed, or chose to spend fewer trials than they needed, both initial learning and retention fell, and the shortfall was not a marginal effect but the direct determinant of whether mastery occurred [15]. When time spent was deliberately maximised and time needed deliberately minimised through better task design and incentives, retention improved most for precisely those learners who had initially spent less time than they needed [16]. The mastery learning literature, synthesised in the same period, generalised the point into a programme: feedback, correction and additional time, applied at the level of the learning unit, could compress the distribution of achievement that fixed time teaching reliably produces [17]. Read together, these sources establish the first proposition of this review. Educational time exists in at least three quantities, allocated, engaged and experienced as success, and each successive quantity is smaller, more variable and more unequally distributed than the one before it. A pedagogy that manages only the first quantity is managing the shadow of learning time rather than its substance.

2. Time needed and the Carroll ratio: pace as a hidden equity variable

The second family gathers around Carroll's ratio, and its central move is to relocate difference. In conventional practice, learners who need longer are described as slower, and slowness is treated as a property of the child. In the Carroll model, the time a learner needs is a joint property of the learner, the task and the quality of instruction, since poor instruction inflates the time every learner needs, and perseverance, the time a learner is willing to spend, interacts with both [4]. The ratio therefore distributes responsibility. A low degree of learning can be produced by a stingy allocation, by weak instruction that raises time needed, or by conditions that erode perseverance, and only the residue belongs to aptitude. Gettinger's programme is the empirical spine of this family, demonstrating in controlled tasks that spending or being given less time than needed depresses achievement in a dose like manner, and that the discrepancy between time needed and time spent is itself predictable from prior achievement and self regulation rather than from fixed ability [15], [16].

Pace is where this family becomes an equity argument. A pacing decision specifies how much content must be traversed per unit of allocated time, and therefore specifies, for

each learner, whether allocated time will exceed or fall short of time needed. Uniform pacing across a heterogeneous class guarantees a patterned shortfall: learners with greater time needed, who are disproportionately those with less prior knowledge, less support outside school and fewer of the linguistic resources schooling presupposes, are systematically given less time than they require, unit after unit, year after year. The shortfall compounds, because each unit's unmastered prerequisites raise the time needed for the next. This is the sense in which pace is a hidden equity variable. It does not appear in lists of the determinants of inequality, it is rarely debated as policy, and it presents itself as a mere administrative necessity, the pace we must keep to cover the curriculum. Yet the charted evidence shows it operating as a conversion mechanism that turns differences in starting position into differences in outcome while appearing to treat everyone identically. Bloom saw the remedy as organisational rather than charitable: hold the standard constant, let time vary, and build the correction loops that make variation usable inside real classrooms [5]. The mastery synthesis confirmed that such arrangements shift achievement distributions rather than merely raising means [17]. Equity in time, on this evidence, is not giving everyone more of the same time. It is giving time in proportion to need, which uniform schedules are structurally unable to do.

The mechanism is worth tracing in slow motion, because it explains why pacing escapes political attention. A curriculum guide divides a fixed body of content by a fixed number of weeks, and the quotient becomes the official pace. Teachers experience the quotient as professional obligation, and learners who fall behind it experience their position as personal failure, although the arithmetic guaranteed in advance that learners whose time needed exceeded the quotient would fall behind. Reviews of extended time repeatedly encounter the residue of this arithmetic, since added days are usually filled by extending the same pace over more content rather than by relaxing the pace over the same content, which is one reason their effects are smaller than advocates expect [7]. The multidimensional account of time in school makes the same point from the measurement side: systems record the scheduled quotient with great precision while leaving time needed, the denominator of Carroll's ratio, entirely unmeasured [8]. A variable that is nowhere recorded can nowhere be governed, and pace accordingly governs learning outcomes without ever appearing as a decision that someone made and someone could remake. Making pace visible, as a stated and contestable design choice with a known distribution of time needed beneath it, is the precondition for treating it equitably.

3. Extending time: what the causal evidence does and does not show

The third family asks the policy question in its crudest form: if time matters, does adding time help? The systematic review of extended school day and year research found a small positive average association with achievement across studies published between 1985 and 2009, with clearer benefits for students at risk of school failure, but it also found weak designs, almost no evidence on outcomes other than achievement, and repeated indications that how added time is used matters more than the addition itself [7]. The recent synthesis by Kraft and Novicoff, which combines a conceptual framework with a review of the causal literature and an empirical study of lost time in an urban district, sharpens all three points. Time in school is multidimensional, scheduled time is eroded by absence, transitions and interruption before it becomes instruction, and additional time yields gains chiefly when it amplifies teaching that is already coherent, so that time behaves as a multiplier of quality rather than a substitute for it [8].

The international econometric studies tell a consistent story at system scale. Using within student variation across subjects in PISA, Lavy estimated that additional weekly instruction time raises achievement, with effects substantially smaller in developing countries and larger where accountability and school autonomy make time more productive [18]. Rivkin and Schiman, extending the design, found that the return to instruction time varies with the quality of the classroom environment, to the point that additional time in disorderly classrooms may yield little or nothing [19]. Swiss evidence on instructional time reforms similarly reports positive but context dependent effects on performance [20], and German evidence adds a teacher dimension, showing that the achievement return to an extra hour depends on the qualifications of the teacher who fills it [21]. The pattern across this family is remarkably stable for a literature often described as inconclusive. Time is a real cause, but it is a conditional one. Its productivity is set by the quality of instruction, the orderliness of the environment and the match between the time supplied and the time learners need, which returns the policy question to the pedagogical one. Extending the year while leaving pace, quality and allocation untouched purchases the most expensive quantity of time, the allocated kind, and converts only a fraction of it into the quantities that matter.

4. Timetables and intended time: policy constructions of school time

The fourth family moves from classrooms to the documents that precede them. Official timetables and curricular time allocations are political artefacts: they declare, in hours and periods, what a society counts as knowledge worth time. Benavot and Gad, studying actual instructional time in African primary schools, documented the gap between the official schedule and the time schools actually deliver, as late openings, teacher absence and early closures erode intended time, with the erosion concentrated in the schools serving the poorest communities [22]. The companion global study of intended instructional time, built from official curricular timetables across some ninety countries between 1980 and 2000, found striking international convergence in the architecture of school time, with annual intended hours falling in a band from under five hundred to over one thousand and core subjects claiming predictable shares almost everywhere [23]. The timetable, in other words, is one of the most standardised technologies of modern schooling, and one of the least examined as pedagogy.

Shadow education throws this construction into relief. Bray's analysis of the timescapes of private supplementary tutoring shows a parallel temporal order growing around the official one, governed by clock and calendar time but also by curricular time, by the concentration spans of children, and by family life cycle decisions about when tutoring is worth its cost [24]. Families purchase time, additional engaged hours, earlier coverage, repeated exposure, to compensate for the temporal rigidities of the public system, and they purchase it unequally. The existence of a thriving market in supplementary time is diagnostic evidence about the main system: where allocated time is uniform and pace is fixed, those with resources buy the variation that the institution will not supply. A scoping of this family therefore adds a distributional warning to the design discussion. Temporal inflexibility in public provision does not eliminate temporal differentiation. It privatises it.

5. Acceleration and its discontents: cultural constructions and slow movements

The fifth family treats time not as a resource to be counted but as an order to be interpreted. Its historical anchor remains Thompson's account of how industrial

capitalism replaced task orientation with clock discipline, and of how schools, churches and employers jointly taught the new time sense until it felt like nature [1]. Glennie and Thrift complicated the story, showing that clock time consciousness developed unevenly through trade, literacy and religion as well as through the factory, which matters for education because it means temporal orders are layered and contested rather than imposed in a single act [25]. Adam's work supplies the conceptual vocabulary for this layering: timescapes combine timing, tempo, duration, sequence and rhythm, and her study of modernity's invisible hazards extends the analysis to the way institutions impose their timescapes on bodies and environments that keep different time [26]. Rosa's sociology gives the layering a direction. His early formulation of acceleration as the ethical and political problem of a desynchronised high speed society [27], developed into the full theory of social acceleration [3], predicts that educational institutions will experience chronic temporal strain, as the pace of knowledge change, policy change and technological change outruns the pace at which children develop and teachers can thoughtfully work.

The sociology of education has begun to absorb this agenda explicitly. Lingard and Thompson argue that the field's spatial turn left its implicit clock time assumptions untouched, and they propose multiple temporalities and the notion of timespace as correctives, noting the asymmetry between the analogue, co present time of classrooms and the digital time students inhabit elsewhere [28]. Lingard's subsequent intervention presses the point into policy sociology, recovering the historical dimension of policy work against a fetishisation of the present and the future [29], and recent scholarship extends the argument through Koselleck's theory of historical times, treating policy itself as a meeting place of layered temporalities [30]. Compton-Lilly's longitudinal literacy research shows what this means at the scale of a child's life: learners are read by institutions through single temporal snapshots, while their literate trajectories, identities and family histories unfold across timescales that snapshot assessment cannot see, so that children are misrecognised as slow when they are simply being measured at the wrong timescale [31]. The slow movements translate this critique into practice oriented claims. Their shared premise is that some goods, understanding among them, are constituted by the time they take and are damaged, not merely delayed, by compression. Section 8 returns to their design implications.

6. Redesigning time: competency based progression and digital self pacing

The sixth family is defined by attempts to rebuild the temporal architecture rather than to optimise within it. Competency based education is the most fully articulated of these attempts, and its defining gesture is temporal: the international consensus statement on competency based medical education describes a paradigm organised around competencies and learner centredness that explicitly de-emphasises time based curricular design, treating time as a resource to be deployed flexibly in the service of outcomes rather than as the organising unit of the curriculum [32]. The parallel with Bloom is direct and acknowledged in the tradition. Where the credit hour certifies exposure, competency frameworks certify demonstrated capability, and progression becomes a function of evidence rather than of the calendar. The scoping of this family, however, also surfaces its unresolved tension. De-emphasising time in design does not abolish time in experience. Learners still need widely varying amounts of it, programmes must still schedule teachers, placements and assessments, and systems that declare time variable while funding and staffing it as fixed reproduce the Carroll shortfall under a new name.

Digital platforms intervene at exactly this point, because they can vary pace at a granularity no timetable can match. The charted evidence on technology supported self regulation in online learning shows platforms increasingly supplying the scaffolding, prompts, analytics and adaptive sequencing through which learners distribute their own study time, with artificial intelligence applications being used to support the self regulated management of when and how long to study [33]. Self pacing, in this literature, is not the absence of temporal design but its relocation, from the institution's calendar to a negotiated space shared by learner, teacher and algorithm. The equity stakes of the relocation are double edged. Done well, it delivers the variation in time that Section 2 identified as the equity requirement, at scale. Done badly, it transfers the burden of temporal self management to precisely those learners least equipped with the prior knowledge, quiet space and adult support that successful self pacing presupposes, while dashboards render their pace visible as a new basis for judgement. The design question is therefore not whether pace should be personalised, but who controls the personalisation, what floors of allocated support are guaranteed, and which temporal decisions remain pedagogical rather than algorithmic.

7. A synthesis map of the field's constructs

The charting exercise yields a map that can be stated compactly. Across 35 sources spanning six decades, educational time is constructed in five families. The first constructs time as quantity, allocated by institutions, engaged by learners and experienced as successful learning, with each quantity nested inside the previous one [6], [14]. The second constructs time as a ratio, the relation between time spent and time needed, from which pace and its equity effects follow [4], [15], [16]. The third constructs time as treatment, an input whose causal return on achievement is real but conditional on quality, order and fit [7], [8], [18], [19], [20], [21]. The fourth constructs time as institution, the intended allocations of timetables and curricula and the shadow orders that grow around them [22], [23], [24]. The fifth constructs time as culture, the layered temporalities of clock discipline, acceleration and lived trajectory within which all the other constructs operate [1], [2], [3], [25], [26], [27], [28], [29], [30], [31]. Two design movements, competency based progression and digital self pacing, cut across the families by attempting to rebuild the relations among them [32], [33].

Three features of the map deserve emphasis. First, the families are ordered by the visibility of their object. Quantity is the easiest to count and dominates policy, while culture is the hardest to count and dominates experience, and much confusion in the field comes from arguing across families, as when a cultural complaint about acceleration is answered with a quantity of additional hours. Second, the families disagree about where time lives. For the quantity and treatment families it lives in schedules and classrooms. For the ratio family it lives in the relation between a learner and a task. For the cultural family it lives in history. A mature learning design has to hold all three locations at once. The map also clarifies why single strand reforms disappoint. A system that extends the year is intervening in the quantity family while leaving the ratio untouched, so its gains are capped by the unchanged relation between pace and time needed. A platform that personalises pace is intervening in the ratio while leaving the cultural family untouched, so its learners may move at individual speeds inside an institutional order that still ranks them by age cohort and still rewards acceleration as such. A slow movement intervention works on the cultural family while leaving quantities untouched, which is why its critics can always ask what happens to coverage and completion. The synthesis claim of this

review is that educational time becomes a pedagogical construct only when a design states, for each family, what it intends: how much time, distributed by what rule, at what pace, inside what temporal culture, and with what experience for the learner who must live through it. Stating the intention does not settle the trade offs among families, since time given to depth is time taken from coverage and time flexed for one learner is scheduled against the time of teachers and peers. It does, however, move those trade offs from the realm of inherited routine into the realm of professional argument, where they can be examined, justified and revised. Third, the map has a conspicuous gap. Very few charted sources study experienced time directly, from the learner's side, over long durations. The longitudinal exception proves the rule [31], and the near absence of student temporal experience from a literature about students' time is the clearest research gap this review identifies, alongside the scarcity of non achievement outcomes in the extended time literature noted by its reviewers [7].

8. Design principles: treating time pedagogically rather than administratively

The final task of a scoping review is to state what the map makes possible. The charted literature supports a set of design principles for treating time as a pedagogical construct. The slow scholarship literature contributes the first. Berg and Seeber argue that the culture of speed in the academy damages teaching, research and collegiality, and that reclaiming time for thought is a professional and pedagogical act, not a private indulgence [34]. The feminist geography collective behind the slow scholarship manifesto adds that slowness must be organised collectively and defended as an ethic of care, since individually negotiated slowness simply shifts accelerated burdens onto colleagues and students [35]. Translated into learning design, the principle is that depth requires protected duration: curricula should name the learning for which slowness is the method, extended inquiry, revision, reading, making, and defend the time those activities take against coverage pressure, rather than allowing pace to be set by the arithmetic of content divided by weeks.

The remaining principles follow from the earlier families. Design for the ratio, not the allocation: specify for each unit the time learners are expected to need, build diagnosis of time needed into formative assessment, and treat a persistent gap between time needed and time spent as a design fault before treating it as a learner fault [4], [15]. Audit the conversion of time: measure how much allocated time becomes engaged time and how much engaged time becomes successful learning time, and publish the conversion losses, since they concentrate predictably on the learners with least support [6], [8], [14]. Vary time before varying expectations: where a standard matters, let completion time flex within honest limits, through mastery structures, reassessment windows and competency based progression, and fund the flexing rather than merely announcing it [5], [17], [32]. Govern pace explicitly: require pacing decisions, including algorithmic pacing in digital platforms, to be justified pedagogically, monitored for patterned shortfalls among groups of learners, and open to teacher and learner override [28], [33]. Finally, respect multiple temporalities: design calendars, deadlines and assessment regimes that acknowledge developmental time, family time and cultural time as real constraints and real resources, and evaluate reforms against a range of outcomes wider than test scores, including wellbeing, motivation and the quality of students' temporal experience [23], [29], [31]. Time will be designed in any case, by timetable committees, platform engineers and funding formulas. The choice the literature lays out is whether it will be designed pedagogically, with learning as the criterion, or administratively, with convenience as the criterion and learning left to absorb the consequences.

CONCLUSION

This scoping review set out to map how educational scholarship constructs time, and it found a field that speaks of time in at least five voices: as quantities allocated, engaged and experienced; as a ratio between time spent and time needed; as a treatment whose returns depend on quality; as an institution embodied in timetables and shadow systems; and as a culture of clock discipline and acceleration within which learners live their trajectories. Read together, these voices support one conclusion. Time in education is not the stage on which pedagogy happens but one of its principal materials, and pace, the least discussed of its properties, functions as a hidden equity variable that converts unequal starting positions into unequal outcomes whenever time is supplied uniformly and need is not. The practical consequence is a reallocation of professional attention: away from the administrative question of how time is filled, and towards the pedagogical questions of how much time each learner needs, how much of the allocated time becomes successful learning time, who controls pacing in competency based and digital designs, and which learning deserves protected slowness. A research agenda follows as well, centred on learners' experienced time over long durations and on outcomes beyond achievement. Schools and platforms will continue to run on clocks. The contribution of this review is to show, from the mapped evidence, that the clocks themselves are curriculum, and that designing them well is teaching.

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