

VHS Kids A Human Design-Informed Profession Simulation for Children Based on Schank's Expectation Failure Theory

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Abstract

This article introduces VHS Kids, a profession simulation module embedded within the SWARP adaptive collaboration platform. Children aged approximately 10 to 14 assume the role of one of over 1,000 real-world professions and navigate authentic work scenarios generated by a large language model. The module rests on four interlocking theoretical foundations: (1) Roger Schank's Expectation Failure Theory and his original Virtual High School concept; (2) Human Design reinterpreted as a quaternion bio-field resonance framework (Konstapel, 2026a), in which the five energy types constitute rotation classes of a dynamic bio-electric field and profession matching is treated as resonance-pattern detection; (3) the Active Inference paradigm (Free Energy Principle) that underpins the broader SWARP architecture; and (4) McWhinney's four realities, recast as quaternion operators structuring a taxonomy of professional prediction errors.

We describe the pedagogical rationale, the technical implementation, the five-act narrative engine, and the quaternion operator profiling system. Key child-safety design decisions — most notably the deliberate absence of child authentication — are explained alongside their privacy implications. Version 3 extends prior versions by: unifying author attribution; renaming the scalar operator to Integration (L_s); adding a mandatory transparency notice for the Match badge; introducing a pseudonymized child identifier for longitudinal tracking; specifying an age-band matrix for operator introduction; honestly separating the current keyword implementation from the theoretical resonance claim; introducing a post-session resonance score; adding a 48-hour retry policy; and providing an Implementation Readiness Checklist (Appendix A).

1. Introduction

Career orientation for children has long relied on informational approaches: classroom presentations by professionals, workplace visits, aptitude questionnaires. These methods share a structural limitation: they describe professions from the outside rather than enabling the child to experience them from within. A child can be told that a surgeon operates under cognitive pressure with incomplete information; no informational account can substitute for the phenomenology of that situation.

Roger Schank (1994, 2011) argued that genuine learning requires doing, failing, and understanding the failure. His Virtual High School concept proposed computer-mediated professional simulations as the primary vehicle for occupational learning, replacing declarative instruction with experiential scenarios designed to elicit and exploit prediction errors. Although Schank's original design targeted secondary-school students, the underlying thesis — that expectation failure is the engine of

knowledge construction — applies with equal force to younger learners who are still forming their initial models of professional reality.

The SWARP platform (Swarm-based Adaptive Responsive Platform) is built on Karl Friston's Free Energy Principle (Friston, 2010): all meaningful learning and governance emerge from the continuous minimisation of variational free energy — the divergence between what an agent expects and what it encounters. VHS Kids instantiates this principle at the level of the individual child. Each simulated work event is designed to surface one of four canonical prediction-error types; the AI feedback loop supports the child in constructing a revised, more accurate professional mental model.

A second layer of personalisation derives from Human Design (Rave, 1992). Version 1 treated Human Design as a typological heuristic for profession matching. Version 2 deepened this claim substantially, drawing on Konstapel (2026a) to propose that Human Design is a phenomenological mapping of the human organism as a dynamic quaternion bio-field, and that profession matching is therefore a form of resonance-pattern detection between the child's bio-field rotation class and a professional domain's energetic signature. Version 3 introduces an important epistemic clarification: the current implementation of this resonance claim is a keyword co-occurrence check, not a phase-locking detector. The gap is named, and the remediation path is specified.

2. Theoretical Foundations

2.1 Schank's Expectation Failure Theory

Schank's account of cognition centres on the script: a generalised event schema that guides behaviour in familiar situations without deliberate attention. Learning occurs when a script fails — when reality deviates from expectation in a way that forces the learner to interrogate the failure, revise the underlying model, and store the revision as a more refined script (Schank & Abelson, 1977; Schank, 1999). The pedagogical corollary is direct: education that systematically avoids prediction error systematically avoids learning. Only the learner who fails has a reason to explain.

Schank's Virtual High School operationalises this thesis at scale. Students occupy professional roles and face decision points engineered to elicit predictable errors — errors the system exploits as structured teaching moments. The child does not receive an account of how a doctor might misdiagnose; as a simulated doctor, the child makes a reasoning error, experiences the narrative consequence, and receives feedback that names the error type and proposes a corrective mental model. VHS Kids inherits this architecture, adapting it for younger learners through simplified language, compressed narrative arcs, and age-appropriate scenarios, while preserving the core structure of failure-driven learning.

2.1.1 The Non-Commutative Geometry of the Learning Trajectory

The quaternion operator framework introduced in Section 2.2 is not merely a convenient taxonomy of failure types. It has a formal geometric interpretation that bears directly on how VHS Kids is designed (Konstapel, 2026d).

The cognitive state of a learner at any moment can be represented as a unit quaternion $q(t)$ on the 3-sphere S^3 , where the scalar component $a(t)$ represents integrated, stable knowledge and the imaginary components $b(t)$, $c(t)$, $d(t)$ represent active cognitive tensions — distinctions being held, perspectives being processed, models being tested. The three operators L_i , L_j , L_k are rotations

in this space. Their critical property is non-commutativity: $L_i L_j(q) \neq L_j L_i(q)$. The sequence in which a child observes, abstracts, and applies determines their cognitive trajectory — not as a pedagogical preference but as a geometric necessity. This is the formal reason why the five-act narrative structure follows a fixed operator sequence rather than presenting all failure types simultaneously.

Under repeated iteration — the child returning to the same profession across multiple sessions — the learning trajectory takes the form of a helix on S^3 . Each cycle revisits structurally similar cognitive operations but from a shifted orientation, representing a deeper level of integration. The helix's pitch $P = da/d\theta$ measures the rate of knowledge integration per cognitive cycle: how much stable understanding the child gains per pass through the operator sequence. This provides a geometric rationale for the multi-session design of VHS Kids. The post-session resonance score (Section 3.4) is, in this framework, an empirical approximation of the helix pitch: a measure of how much integration each session produced.

2.1.2 Phase Inversion: The Mechanism of Transformative Learning

The most significant prediction of the non-commutative model concerns the qualitative restructuring events that mark genuine developmental transitions. A fundamental property of the unit quaternion space is that q and $-q$ represent the same observable orientation in three-dimensional space but distinct internal states — the $SU(2) \rightarrow SO(3)$ double cover. The transition $q \rightarrow -q$, termed *phase inversion*, is a discrete topological jump: every relational orientation in the learner's cognitive structure is simultaneously inverted. This is not a metaphor for "changing perspective"; it is a formal consequence of the geometry.

Phase inversion requires the conjunction of two conditions. First, the learner must have completed a full operator cycle ($L_i \rightarrow L_j \rightarrow L_k$), returning the system to a point on S^3 that is topologically prepared for the transition. Second, at precisely this moment of return, an expectation failure must occur — the script the learner implicitly held is violated. Neither condition alone is sufficient: random disruption does not produce transformation, and a completed cycle without failure produces only incremental helical advance.

This mechanism grounds Mezirow's (1991) "disorienting dilemma" and Kegan's (1994) developmental leap in a common geometric structure. For VHS Kids, it specifies what Act 3 (Crisis) must accomplish: not merely a difficult scenario, but a carefully timed expectation failure delivered at the point of operator-cycle completion — the precise conditions for phase inversion. The five-act arc is an engineering specification for producing this conjunction reliably across a diverse population of children.

A critical aspect of Schank's framework that VHS Kids takes seriously is one he identified but did not operationalise: the timing question. Schank assumed, implicitly, that the learning sequence self-initiates when failure occurs. This holds at the individual level on short timescales. It does not hold across developmental stages spanning years: a child who is not yet cognitively ready to process a specific failure type will not learn from it — the failure will be experienced as noise rather than signal, producing disengagement rather than revision. The age-band operator introduction matrix (Section 3.2) is the VHS Kids answer to this timing question: it determines not only which failures to generate, but when a child is developmentally ready to process each class of failure productively. The 48-hour retry window (Section 3.5) addresses the complementary timing constraint: within a single profession, multiple failure–recovery cycles must be possible within a window short enough that the prior case remains cognitively active. These are not design conveniences; they are direct engineering responses to the timing problem Schank left open.

2.2 The Quaternion Operator Model of Expectation Failure

SWARP extends Schank's binary failure/success model using a quaternion operator framework derived from Konstapel's reinterpretation of McWhinney's Four Realities (McWhinney, 1997; Konstapel, 2026b). Four canonical modes of professional cognition are identified, each generating a characteristic failure type when misapplied:

- **L_i (Observation):** perception and evidence gathering. Failure mode: treating unverified assumptions as established facts. Child-facing label: *"You assumed something without checking."*
- **L_j (Abstraction):** model-building and categorisation. Failure mode: applying an inappropriate conceptual schema to a novel situation. Child-facing label: *"You used the wrong way of thinking about it."*
- **L_k (Application):** contextual judgement. Failure mode: applying a correct model in the wrong context. Child-facing label: *"That would work somewhere else, but not here."*
- **L_s (Integration):** stakeholder alignment and systemic coherence. Failure mode: arriving at a technically correct solution that lacks social or organisational buy-in. Child-facing label: *"Your answer was right, but the people around you weren't with you."*

The notation L_s follows the quaternion algebra; the pedagogical term throughout is **Integration**. The simulation engine tracks which operator each child most frequently exercises and which most frequently generates failures, producing a quaternion operator profile — a four-dimensional fingerprint of current cognitive tendencies. Accumulated across sessions and professions, this profile constitutes a longitudinal map of professional cognitive development.

2.3 Human Design as a Quaternion Bio-Field Resonance Framework

2.3.1 The Theoretical Shift

Version 1 treated Human Design as a heuristic typology operating outside validated science. Version 2, grounded in Konstapel (2026a), advanced a stronger theoretical claim: Human Design is a phenomenological mapping of the human organism as a dynamic quaternion bio-field.

Under this interpretation:

- The nine Centres of the Human Design bodygraph are modelled as components with fixed bio-electric values — the constant terms of the quaternion field equation.
- The Channels are stable coupling terms — off-diagonal elements of the field tensor governing energy propagation between Centres.
- The five Types are **rotation classes** — qualitatively distinct patterns of quaternion field rotation, each with a characteristic convergence behaviour (λ) determining how the organism self-organises in response to environmental stimuli.

This is a mathematical claim, not an analogy. The quaternion algebra describing the bio-field is formally identical to the algebra governing orientation in three-dimensional space. Human Design, in this reading, constitutes a pre-scientific intuition of a bio-electric field topology that contemporary quantum biology and bioelectromagnetics are beginning to formalise (Levin, 2012; McCraty, 2015).

2.3.2 The Five Types as Rotation Classes

HD Type	Quaternion Rotation	Convergen	Strategy under FEP
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Generator	Strong axial rotation around b,i (sacral)	High	Respond to stimuli; minimise free energy through sustained engagement
Manifesting Generator	As Generator + d,k coupling	High, multi-harmonic	Respond then inform; harmonic skip across domains
Manifestor	Dominant outward rotation	Medium	Initiate; compress free energy into action
Projector	Low self-rotation, high	Low, long	Wait for invitation; resonance-reading of
Reflector	Near-zero fixed components, 28-day sampling cycle	Very low, lunar period	Full environmental sampling; lunar-periodic coherence

Each rotation class entails a characteristic resonance signature: a pattern of stimuli to which the organism most readily phase-locks, and a complementary pattern that increases rather than decreases free energy. A Generator placed in a Projector-type environment experiences sustained free-energy increase — phenomenologically, frustration. A Projector in a Generator-type environment encounters the symmetric mismatch — phenomenologically, bitterness.

2.3.3 The Hopf Fibration and the SWARP Spiral Navigator

The mathematical substrate of this model is the Hopf fibration $S^3 \rightarrow S^2$. A unit quaternion lives on the 3-sphere S^3 and projects onto the 2-sphere S^2 as a visible orientation in physical space. The fibres of this projection — circles mapping to each point on S^2 — represent the internal degrees of freedom of the field: the rotation producing a given observable behaviour from a given internal state.

This is precisely the structure of the SWARP Spiral Navigator (Konstapel, 2026b): the NavigatieKaart projects a four-dimensional quaternion state onto a two-dimensional observable trajectory. Human Design's Strategy and Authority guidance constitutes, in this framework, the optimal control policy for a quaternion bio-field agent under the Free Energy Principle — the control law that minimises expected free energy over time given the agent's rotation class. The implication for VHS Kids is that profession matching is not keyword retrieval but a resonance probe: a test of whether a profession's characteristic energy demand is likely to phase-lock with the child's rotation class or to produce sustained field divergence.

2.3.4 Professional Resonance Signatures

HD Type	Characteristic professional domains
Generator	Sustained high-throughput work with tangible output: construction, cooking, sport,
Manifesting Generator	Multi-domain rapid iteration: entrepreneurship, surgery, creative direction, product design
Manifestor	Initiation and impact: leadership, founding, journalism, arts direction
Projector	Depth of insight into systems and individuals: medicine, research, psychotherapy, consulting, specialised craft mastery
Reflector	Social and environmental texture: community roles, arts, education, environmental

These domain signatures are probabilistic, not deterministic. The bio-field model predicts statistical tendencies toward resonance; it does not prescribe individual fate. The ★ Match badge reflects this probabilistic character: an elevated prior probability of energetic congruence, open to revision by direct experience.

2.3.5 Epistemological Status and Transparency Notice

The quaternion bio-field reinterpretation of Human Design is a theoretical proposal, not an empirically validated model. Three categories of evidence are required to advance from proposal to established theory:

1. **Bio-electric measurement studies:** direct correlation of HD type with measurable bio-electric parameters (HRV spectral topology, galvanic skin response autocorrelation, EEG coherence patterns).
2. **Behavioural outcome studies:** longitudinal correlation of HD-type profession matching with engagement, satisfaction, and performance across diverse populations.
3. **Free energy trajectory studies:** within-session physiological measurement as a proxy for free energy, comparing HD-matched and HD-mismatched simulations.

None of these studies has yet been completed (Konstapel, 2026a).

Mandatory transparency notice (UI element): Every ★ Match badge must be accompanied by the following notice, displayed on first encounter per session: *"This is a theoretical prediction, not a proven assessment. The best match is whatever profession your child is curious to try."* This notice guards against the primary misuse risk: treating the Match signal as a deterministic occupational prescription.

2.5 Fractal Karma, the Enneagram, and the Interruption of the Learning Cycle

2.5.1 Fractal Karma as Structural Determinism

The SWARP model introduces the concept of *fractal karma* to account for a phenomenon familiar to every practitioner of human development: competent individuals consistently repeat the same failures across entirely different contexts. Classical psychology labels this a repetition compulsion; the SWARP model provides a generative, algebraically grounded account.

Fractal karma is defined as the deterministic recurrence of a dominant expectation failure mode encoded in the individual's birth-fixed PoC quaternion. The recurrence is not a psychological compulsion but a consequence of the fractal structure of reality itself (Konstapel, 2025): because the same self-similar ordering principle operates across all scales of organisation, the same failure type manifests structurally across an individual's personal development, team dynamics, organisational role, and — at the largest scale — democratic process. A person with a dominant Green (Social) component will not only struggle with relational ruptures in personal life; their organisation will repeatedly fail to retrieve and apply prior-case knowledge, and they will recognise the same political impasse in the societies around them.

This fractal self-similarity has a direct pedagogical consequence for VHS Kids. A single simulation session is insufficient not because the child lacks ability, but because the dominant failure mode is structurally recurrent. The 48-hour replay window (Section 3.5) and the longitudinal operator profile (Section 3.1) are not conveniences; they are necessities imposed by the fractal structure of learning itself.

2.5.2 The PoC Quaternion and the Schank CBR Cycle

The four quaternion operators introduced in Section 2.2 map directly onto the four sub-processes of Schank's Case-Based Reasoning (CBR) cycle:

CBR sub-process	PoC worldview	Quaternion operator	Dominant failure
Expectation	Unitary	L_i	Treating assumptions as verified facts
Case retrieval	Social	L_j	Applying the wrong schema; failing to retrieve
Contextual application	Sensory (Red)	L_k (Application)	Applying a correct model in the wrong context
Script revision	Mythic (Yellow)	L_s (Integration)	Technically correct solution lacking social buy-in; core narrative unrevised

The dominant component of the individual's PoC quaternion therefore predicts the specific sub-process at which their learning cycle will characteristically break down. This is the algebraic basis of the quaternion operator profile that VHS Kids accumulates across sessions: not a general competence measure, but a precise map of where in the CBR cycle the child's revision process stalls.

2.5.3 The Enneagram as a Taxonomy of Avoidance

The fractal karma model describes the *topology* of breakdown — where in the cycle the failure occurs. The Enneagram (Naranjo, 1994; Riso & Hudson, 1999) supplies the complementary mechanism: it describes the *defensive strategies* by which individuals actively prevent their failures from producing the script revision those failures require.

Each Enneagram type is organised around a core fear and a compulsive avoidance strategy. Mapped onto the CBR cycle, the nine types reveal distinct interruption points:

- **Types 1 and 5 (Blue/Unitary dominant)** interrupt at the *retrieval* step. Type 1 responds to a failing system by intensifying the existing script — adding more rules, more rigour — thus preventing recognition that the script itself is the problem. Type 5 accumulates knowledge as a buffer against action; the script "*I will act when I know enough*" is self-sealing.
- **Types 3 and 4 (Yellow/Mythic dominant)** interrupt at the *revision* step. Type 3 revises the narrative surface while leaving the underlying script intact, defending against disconfirming evidence through performance and image management. Type 4 aestheticises failure, converting the unrevised script into identity — acknowledged but never genuinely transformed.
- **Type 7 (Red+Yellow dominant)** outruns the entire cycle by generating a continuous stream of new experiences, preventing any single failure from achieving the weight necessary to compel revision.
- **Type 8 (Red dominant)** short-circuits the cycle at the *expectation* step through preemptive force; failure, when it occurs, is externalised rather than registered.
- **Types 2, 6, and 9 (Green/Social dominant)** interrupt at the *registration* step. Type 2 ensures that relational failures are attributed to the ingratitude of others. Type 6 generates a recursive search for reliable authority that ensures authority will eventually fail. Type 9 suppresses personal agency, holding no strong expectations and therefore producing no registerable failures.

The practical implication for VHS Kids is significant. The operator profile accumulates data on *which* operator most frequently generates failures (the fractal karma topology). The Enneagram layer — not yet implemented — would add data on *how* the child responds to those failures: whether they intensify the existing approach (Type 1/5 pattern), reframe the stakes (Type 3/4 pattern), or disengage (Type 7/9 pattern). This second-order signal would allow the feedback engine to distinguish between a child who failed and learned from one who failed and defended, and to calibrate the recovery tip accordingly.

2.5.4 The RIASEC Projection

The PoC quaternion does not only predict failure topology; it also projects directly onto vocational direction. Via a fixed transformation matrix M , the four quaternion weights map onto Holland's (1997) six-dimensional RIASEC space:

$$\mathbf{v}_{\text{RIASEC}} = M \cdot [w_{\text{B}}, w_{\text{R}}, w_{\text{G}}, w_{\text{Y}}]^T$$

This vector is then matched against the O*NET occupational interest profiles to generate a ranked list of profession candidates — the same database that underlies the VHS Kids professional database (Section 4). The critical insight is that vocation and fractal karma are two expressions of the same quaternion coordinate. The optimal profession for a child is not the one that minimises failure, but the one that generates the *correct sequence* of failures for their dominant learning topology. A child with a dominant Red (Sensory) component learns most effectively in a professional domain where physical, financial, or somatic feedback is immediate and unavoidable. A child with a dominant Blue (Unitary) component needs a domain where maintaining systemic integrity is the central challenge.

The HD-type resonance matching (Section 2.3) and the RIASEC vocational projection are therefore convergent signals, not independent ones: both derive from the same underlying quaternion coordinate. The Match badge, at its theoretical target (Section 3.4, Phase 4), is a resonance probe testing whether a profession places the child in productive relationship with their specific failure mode — not a compatibility score in any conventional psychometric sense.

2.4 Active Inference and the Free Energy Principle

SWARP is built on Friston's Active Inference framework (Friston, 2010; Friston et al., 2017): biological and social systems minimise variational free energy by continuously refining a generative model of the environment. Learning is not information accumulation but model refinement — the reduction of prediction error through selective action and belief updating.

VHS Kids instantiates this principle at the level of professional mental models. Prior to simulation, the child's model of a given profession is sparse and stereotype-laden. Each simulated event presents a situation calibrated to violate some aspect of that model. Narrative consequence and structured AI feedback together constitute a precision-weighted prediction error signal that drives model revision. After repeated sessions, the child's professional model is richer, more nuanced, and more resistant to elementary errors.

The HD-resonance and Active Inference layers are not independent. In the quaternion bio-field model, the child's rotation class determines which professional environments generate low free energy (resonance, engagement) and which generate high free energy (mismatch, disengagement). HD matching is used to direct the child toward a low-free-energy starting zone, where prediction errors remain pedagogically productive rather than demotivating.

3. System Architecture

3.1 Child Profile, Parent Mediation, and Longitudinal Tracking

VHS Kids does not support independent child accounts. All access is mediated through an authenticated parent SWARP account. The parent creates a child profile containing name, date of birth, and HD type via the SWARP Kids module.

This design reflects three considerations. First, it eliminates child-specific authentication infrastructure, which carries significant GDPR and child online privacy obligations in the European regulatory context. Second, it frames the simulation as a joint parent–child activity rather than an isolated child-facing product (Takeuchi & Stevens, 2011). Third, it ensures that the Seeds micropayment system is administered by an adult.

Pseudonymized longitudinal identifier (Version 3): The absence of child logins creates a tension with Schank's requirement for many failure–recovery cycles accumulated across professions and developmental stages. VHS Kids resolves this without creating child authentication credentials by deriving a pseudonymized child key from a one-way hash of: child name + date of birth + parent account ID. This key is never stored in plaintext; it cannot authenticate; it cannot be traced to the child without simultaneous access to all three inputs. The parent must explicitly opt in to longitudinal tracking at child profile creation. With opt-in, session data is indexed to the pseudonymized key and the operator profile accumulates over time. Without opt-in, each session is stateless. This design satisfies GDPR's data minimisation principle while enabling the longitudinal developmental record that gives the operator profile its highest analytical value.

3.2 The Five-Act Narrative Engine and Age-Band Operator Introduction

Each simulation follows a five-act dramatic structure:

- **Act 1 — Arrival:** The child enters the organisation as a newcomer. Tasks surface hidden assumptions. Primary operator: L_i (Observation).
- **Act 2 — Routine:** Tasks grow in complexity. Primary operators: L_i and L_j (Abstraction).
- **Act 3 — Crisis:** A major failure pattern emerges under pressure. All four operators may be engaged; the engine prioritises the child's least-exercised operator.
- **Act 4 — Mastery:** The child operates with growing competence on revised models. Primary operators: L_k (Application) and L_s (Integration).
- **Act 5 — Denouement:** The narrative concludes with structured reflection on what changed in the child's professional thinking across the arc.

Each act contains two events: a narrative setup, a concrete task description, and a free-text response field, generated by a large language model parameterised by profession, act, and targeted operator.

Age-band operator introduction matrix: The four operators differ substantially in their metacognitive demands. The following matrix governs which operators are introduced at each age band:

Age band	Operators introduced	Child-facing feedback label
10–11	L _i , L _j	"You assumed without checking" / "You used the wrong idea"
12–13	+ L _k	"That would work elsewhere, but not in this situation"
14	+ L _s (Integration)	"Your answer was right, but the people around you weren't with you"

The simulation engine reads the child's date of birth from the profile and selects the active operator set accordingly. For children aged 10–11, L_s failures are remapped to the closest L_j equivalent,

preventing the metacognitive overload that follows from presenting integration failures before abstraction-level self-awareness is consolidated.

3.3 The Feedback Loop

Following each event response, the feedback engine executes a second AI completion that: (1) evaluates the response against the targeted failure pattern; (2) generates a *feedbackNarrative* — a short story continuation showing the consequences of the child's decision; (3) identifies the most visible operator; (4) diagnoses whether a failure occurred and names it using the age-appropriate label; (5) produces a *recoveryTip* — one or two positively framed sentences of concrete growth advice; and (6) awards 10–30 XP, weighted toward reflective and concrete responses.

3.4 HD-Type Matching: Current Implementation and Resonance Roadmap

Honest separation of theory and implementation (Version 3): The quaternion bio-field model describes profession matching as resonance-pattern detection — a test of whether a profession's energy demand will phase-lock with the child's rotation class. The current implementation is a keyword co-occurrence check: the system tests whether any term from the HD-type keyword set appears as a substring in the concatenated profession text fields, producing a binary Match flag.

These are not equivalent operations. Keyword co-occurrence is a thematic hint — a prior based on vocabulary overlap, not field dynamics. It cannot detect phase-locking, measure convergence behaviour λ , or estimate free-energy trajectories. Presenting the current implementation as a "resonance probe" without this qualification would be technically misleading.

The Match badge therefore carries two separable claims:

Claim	Description	Current status
Thematic hint	"This profession's vocabulary overlaps with your HD type's domain"	Implemented as binary keyword flag
Resonance prior	"This profession's energy demand is predicted to phase-lock with your	Requires embedding-based semantic similarity at minimum; bio-electric measurement for full

Post-session resonance score (Version 3): The richest resonance signal available at present is not the pre-session keyword flag but the child's actual engagement behaviour during simulation: response length, response latency, session completion rate, XP per event, and voluntary return rate. After each completed session, the system computes a post-session resonance score (0–100) from these signals, displayed to the parent as: "*Based on how [child name] engaged with this simulation, the resonance score is 72/100 — above average engagement for this profession type.*" With longitudinal opt-in, this score accumulates into an empirically grounded resonance profile that progressively displaces the theoretical keyword prior.

Implementation roadmap:

Phase	Match algorithm	Signal type
Current	Keyword co-occurrence	Thematic hint
Phase 2	Embedding-based semantic similarity (cosine distance)	Linguistic resonance prior

Phase 3	Post-session engagement signals	Behavioural resonance calibration
Phase 4	Bio-electric measurement correlation	Direct field-level resonance

3.6 VHS Kids Within the SWARP CBL Architecture

VHS Kids does not stand alone as a pedagogical tool; it is one component of a five-scale Case-Based Learning architecture that SWARP implements simultaneously (Konstapel, 2026c).

Understanding where VHS Kids sits within that architecture clarifies both its design constraints and its long-term potential.

The SWARP CBL architecture operates across five nested scales: the individual, the Community of Practice, the organisation, the municipality, and the democratic system. These scales are coupled: knowledge generated at the individual level flows upward to enrich the CoP case base; patterns detected at the CoP level flow upward to inform organisational and municipal script revision; failures institutionalised at the democratic level constrain the scripts available to individuals. VHS Kids operates at Scale 1 — the individual — but its outputs are designed to feed the higher scales.

Within each scale, the architecture follows a five-stage knowledge flow:

Stage	Function	VHS Kids implementation
Collection	Cases enter the system indexed by failure type	Each simulation session generates a case record: profession, act, operator triggered, failure occurred,
Indexing	Cases are tagged for retrieval by domain, PoC-colour, emotion,	Session records indexed by profession domain, dominant operator, age band, HD type, and post-session resonance
Retrieval	Relevant prior cases are surfaced when a new failure occurs	Future integration: when a child returns to a profession, prior session data informs the simulation engine's
Revision	Script revision is supported and recorded	Operator profile update after each session; longitudinal profile accumulation with parent opt-in
Distribution	Revised scripts circulate as inputs for higher scales	Aggregated operator profiles and resonance scores feed the Beroepen Leer Hub; anonymised pattern data feeds

This architecture has a concrete implication for VHS Kids' design: session data is not a byproduct — it is a primary output. Every simulation generates a structured case record that, aggregated across thousands of children and hundreds of professions, constitutes an empirical dataset on the relationship between HD type, developmental age, operator failure topology, and professional domain. This dataset is what makes Phase 3 of the resonance roadmap (Section 3.4) tractable: the post-session resonance score converges toward empirical validity precisely as the case base grows.

The five-stage architecture also clarifies the boundary between what VHS Kids handles internally and what requires platform integration. Collection, indexing, and revision are fully internal to the VHS Kids module. Retrieval and distribution require active coupling to the broader SWARP platform — specifically, the CBR engine, the KennisLink system, and the Beroepen Leer Hub. These integrations are not yet implemented; they represent the next engineering milestone after the core simulation engine is stable.

3.5 The Seeds Economy and Retry Policy

Each simulation start costs 10 Seeds, charged to the parent account and purchased via Mollie iDEAL.

Retry policy (Version 3): Schank's model requires multiple failure–recovery cycles within the same professional domain. A per-attempt charge creates an economic disincentive for the repetition the pedagogy demands. VHS Kids therefore implements a **48-hour replay window**: following a 10-Seeds purchase for a given profession, the child may replay that profession any number of times within 48 hours at no additional cost. A new charge of 10 Seeds applies only when the window expires or the child initiates a simulation with a different profession. This aligns the economic model with the pedagogical model: the investment is in deep exploration of a profession, not in a single narrative run.

4. The Professional Database

VHS Kids draws on a database of 1,016 professions derived from the O*NET occupational taxonomy (US Department of Labor), localised for the Dutch context with Dutch names and descriptions. Coverage spans highly specialised roles (neurosurgeon, quantum physicist, maritime archaeologist) through familiar trades (baker, plumber, football coach) to emerging occupations (AI ethicist, climate adaptation consultant, community energy coordinator).

The breadth of the database is pedagogically deliberate. Children should not be constrained to the professions their immediate social environment can name. The search interface and HD-type resonance hint together create a personalised discovery pathway through a genuinely comprehensive occupational landscape.

5. Pedagogical Implications

5.5 Practice Precedes Theory: The Failure-First Design Principle

A recurring temptation in educational design is to present theory before practice — to equip the learner with the conceptual framework before exposing them to the domain's characteristic failures. The non-commutative learning model (Section 2.1.1) provides a formal argument against this approach (Konstapel, 2026d).

Theory is a compression of a traversed history of failures. A formal framework — whether the operator taxonomy of VHS Kids or the architectural patterns of software engineering — encodes the failure structure of a domain in compressed form. Transmitting that compression to a learner who has not yet traversed the corresponding failure history is transmitting a file without the decompression key: the learner can recite the framework but cannot use it, because the operator structure it encodes has not been internalized through experience. The cognitive state into which theory is received is not yet shaped to receive it.

This is the theoretical basis for the VHS Kids failure-first design. The simulation does not begin by explaining what a pharmacist does or what cognitive skills the role requires. It places the child inside the professional role and immediately exposes them to the domain's characteristic failure patterns. The five-act arc is calibrated so that Act 1 generates observational failures before any abstraction is attempted, Act 2 generates abstraction failures before contextual application is introduced, and Act 3 produces the crisis-level conjunction of failure types that triggers phase inversion (Section 2.1.2). Conceptual vocabulary — the operator labels — arrives in the feedback

loop *after* the failure has been experienced, not before. The label names something the child has already felt; it does not predict something the child has yet to encounter.

This sequencing has a measurable consequence. The operator profile (Section 2.2) accumulates meaningful data only if failures are genuinely experienced rather than anticipated and avoided through pre-loaded theory. A child who has been told "you will probably make an observation error" will perform differently in Act 1 than a child who encounters the error without forewarning. The failure-first design ensures that the operator profile reflects the child's actual cognitive tendencies, not their theory of themselves.

VHS Kids aligns with situated cognition theory (Lave & Wenger, 1991), which holds that knowledge is constituted through participation in communities of practice rather than deposited in individual minds. The simulation creates a virtual community of practice: a fictional organisation in which the child holds a real role and faces consequential decisions.

5.2 Intrinsic Motivation and Self-Determination

Self-determination theory (Deci & Ryan, 2000) identifies three universal psychological needs: autonomy, competence, and relatedness. VHS Kids addresses all three: autonomy through free profession choice (with HD-type guidance non-binding); competence through the graduated five-act difficulty arc and the XP system; relatedness through the fictional organisational context and the co-participating parent.

5.3 Metacognitive Development

The quaternion operator feedback loop names the type of reasoning error the child committed, using age-appropriate labels (Section 3.2). This metacognitive training — attending to one's own cognitive processes rather than only to domain content — is among the strongest predictors of long-term learning outcomes (Hattie, 2009). By labelling Observation, Abstraction, Application, and Integration errors in graduated developmental language, the system equips children with a vocabulary for describing how they reason, not only what they know.

5.4 Resonance-Aware Learning Design

Beyond profession matching, the bio-field resonance model implies that children learn most effectively when the energy demand of the learning environment is congruent with their rotation class. A Generator child learns optimally through sustained, repetitive practice with tangible feedback; a Projector child through depth, invitation, and mastery-over-time; a Reflector child through social richness and environmental variety.

The current implementation does not yet adapt simulation style to HD type: all children receive the same five-act structure. Future development should parameterise act duration, event frequency, social density, and feedback rhythm by rotation class. A Projector child may benefit from an earlier Act 3 (Crisis) — deep challenge is the Projector's learning accelerant. A Generator child may benefit from an extended Act 2 (Routine) — sustained mastery-building is where sacral engagement is most productive.

6. Ethical Considerations

6.1 Child Data Privacy

Because all access is mediated through parent accounts, no child-specific authentication data is stored. The child profile contains only a name (which may be a pseudonym), a date of birth, and an HD type — all supplied by the parent. The pseudonymized longitudinal key is computed on-demand and never stored as plaintext. This architecture satisfies GDPR's data minimisation and purpose limitation principles.

6.2 Epistemic Status of Human Design and the Match Badge

Version 2 described the Match badge as "a theoretically grounded prior." Version 3 reconciles this with implementation reality: the badge is currently generated by a binary keyword flag, not a resonance computation. The "theoretically grounded" claim applies to the eventual target of the implementation roadmap (Section 3.4), not to the current implementation state.

Until Phase 2 of the roadmap is reached, the badge should be labelled "**Thematic hint**" rather than "Match" in the UI, preventing users from attributing more precision to the signal than the implementation warrants. The mandatory transparency notice (Section 2.3.5) applies regardless of implementation phase. Human Design is not a scientifically validated psychometric instrument; the quaternion bio-field model provides theoretical grounding, not empirical validation.

6.3 AI-Generated Content Quality

All simulation scenarios and feedback are generated at runtime by large language models, introducing variability in quality. Mitigation measures include structured prompts with explicit quality constraints, JSON-validated output, and fallback default values when AI responses fail validation.

6.4 Professional Stereotyping

HD-type keyword sets risk reinforcing occupational stereotypes if not actively maintained. These sets should be reviewed regularly and eventually replaced with empirically grounded resonance signatures derived from actual session engagement data (Phase 3 of the roadmap).

7. Integration with the SWARP Ecosystem

VHS Kids is embedded within the broader SWARP platform. The SWARP Kids module supplies the child profile (HD type, age, wellness score) that shapes simulation parameters. The Beroepen Leer Hub shares the professional domain database with the adult professional development module. ARIA Coach can draw on the child's VHS session history — including the quaternion operator profile — to generate contextualised parenting guidance. The Community of Practice layer offers a forward integration: children who have simulated the same profession and show similar operator profiles could form junior CoPs.

The quaternion bio-field model creates a further continuity: the child's HD-type rotation class is mathematically the same object as the adult user's SWARP Spiral Navigator position. As the child grows into the platform, their operator profile and bio-field rotation class can be displayed as a unified longitudinal record — a continuous developmental map from childhood through adult professional life.

8. Future Research Directions

1. Does HD-resonance matching predict session engagement? Do children selecting HD-matched professions complete more acts and return for more sessions?
2. Does operator-targeted feedback accelerate metacognitive development relative to generic feedback?
3. What is the effective age range? Systematic usability testing across developmental cohorts.
4. Does simulation experience influence career aspiration over time? Longitudinal study from age 12 to 18.
5. Can bio-electric measurement validate the resonance model? HRV spectral topology, EEG coherence, and galvanic skin response during HD-matched versus HD-mismatched simulations.
6. Can simulation style be adapted to rotation class? Controlled testing of rotation-class-specific act structures for Generator, Projector, and Reflector children.
7. Does the post-session resonance score converge on the theoretical prior? Do empirical engagement signals, accumulated at scale, reproduce or revise the theoretical keyword rankings?

9. Conclusion

VHS Kids represents the convergence of four theoretical traditions — Schank's experiential learning theory, Human Design reinterpreted as a quaternion bio-field resonance framework, Active Inference, and the quaternion operator model of professional cognition — in service of a concrete educational need: equipping children with richer, more accurate professional mental models before they face consequential occupational decisions.

The system is designed around failure, not success. Version 3 of this paper applies the same principle to itself: rather than overstating the resonance claim, it names the gap between theoretical aspiration and current keyword implementation, specifies the remediation roadmap, imposes honest age-band constraints on metacognitive labelling, introduces a privacy-preserving longitudinal identity mechanism, and adds a Seeds retry policy that aligns economic incentives with pedagogical requirements.

The quaternion bio-field model remains a theoretical proposal awaiting empirical test. The implementation roadmap specifies what those tests look like and what the platform must build to conduct them. A coherent theory, an honest gap analysis, and a specified path from current state to validated state constitute the appropriate epistemic posture for a platform that takes children's learning seriously.

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Appendix A: Implementation Readiness Checklist

#	Theoretical claim	Current implementation	Gap and remediation
	HD type predicts resonance with	Keyword co-occurrence	Gap: thematic hint \neq resonance probe. Remediation: Phase 2 embedding-based similarity; Phase 3
	Match badge = theoretically grounded	Binary keyword flag displayed as	Gap: label overclaims precision. Remediation: rename to "Thematic hint" until Phase 2; mandatory
	Quaternion operator profile accumulates over	Stateless sessions (no longitudinal)	Gap: no longitudinal data without child login. Remediation: pseudonymized child key with explicit
	Multiple failure cycles required (Schank)	Each start costs 10 Seeds	Gap: economic disincentive for retrying. Remediation: 48-hour replay window (Section 3.5)
	L _k and L _s feedback appropriate for all ages	All four operators used	Gap: metacognitive overload for 10–11 year olds. Remediation: age-band operator matrix (Section 3.2)
	Post-session engagement = richer	Not currently computed	Gap: richest available signal unused. Remediation: post-session resonance score (0–100) displayed to
	Bio-field resonance (λ) can be measured	No measurement infrastructure	Gap: validation studies not yet conducted. Remediation: specify HRV/EEG study protocol;