# Reflecting on 25 years of the comprehensive application of behaviour analysis to schooling (CABAS®) model in the UK

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**Abstract**

**Purpose** – *This paper aims to describe the core components of the CABAS® model, highlighting the specific features that have underpinned the success of Jigsaw CABAS School. It also considers the school's role in informing and shaping the continued development of the wider CABAS framework.*

**Design/methodology/approach** – *The paper centres on learn units to criterion data, verbal behaviour development assessments and the staff training programme. It examines how these elements have collectively supported the school's effectiveness and contributed to sustained learner progress.*

**Findings** – *The CABAS model provides a robust measurement framework that ensures each learner's individualised curriculum is appropriately tailored, with targets that are both ambitious and achievable. The positive impact of specific components of the CABAS system on learner progress is described, including the implementation of a curriculum that measures beyond learning directly taught skills. Additionally, the staff training programme, specifically the CABAS rank system, has enhanced staff expertise, thereby further supporting learner progress.*

**Originality/value** – *Measurement of the alignment of the curriculum with learners' current levels of ability is a critical factor in supporting learner success. It is valuable to consider whether components of the CABAS system can be incorporated within other models of pedagogy.*

**Keywords** *Education, Autism, Pedagogy, Teaching, Behaviour analysis in schools*

**Paper type** *General review*

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Jigsaw CABAS® School recently marked its 25th anniversary, providing an opportunity to reflect on its implementation of the CABAS model over this period, the components that have contributed most significantly to the school's success, and the ways in which Jigsaw has contributed to the evolution of the CABAS system. Over this time, the school has achieved five consecutive outstanding Ofsted inspections, maintained accreditation as a CABAS school, supported a substantial number of staff to complete CABAS ranks and Masters qualifications, and enabled learners to reach their full potential. This paper reflects on the role of the CABAS model in these achievements, as well as Jigsaw's contributions to the ongoing development of CABAS.

## Jigsaw CABAS school

Jigsaw CABAS School was established in September 1999 as an independent special school for autistic children. Originally registered for six learners in Key Stage 1 (ages 4–7), the school has expanded over the past 25 years to support 80 learners aged 4–19 years. All learners have a severe to moderate learning disability alongside their diagnosis of autism

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and all require a high level of support. Parental feedback has consistently been positive as evidenced through Ofsted inspections and annual parent surveys. During the most recent 2025 survey, the school was described as "absolutely incredible," "invaluable" and "nurturing." Parents have reported back on the impact of the school on their children in terms of "helping my child to develop and thrive," "enriching the lives of the children" and "educating children in a safe environment at their own pace." One parent stated that "Jigsaw makes a positive difference to our lives as a family."

## CABAS

CABAS is an acronym for the Comprehensive Application of Behaviour Analysis to Schooling. It is a cybernetic and system-wide model of teaching in which principles of behaviour analysis are applied across all components of educational practice. The model was developed by Greer and colleagues from Teachers College, Columbia University, New York (e.g. Greer, 2002; Selinske *et al.*, 1991) and a substantial body of research has demonstrated its effectiveness (e.g., Casarini *et al.*, 2024; Greer *et al.*, 2002, 1989; Hawkins and Grant, 2011; Healy *et al.*, 2008; Lamm and Greer, 1991; Oblak, 2021; Singer-Dudek *et al.*, 2010; Singer-Dudek *et al.*, 2021).

Since 1999 Jigsaw has used the CABAS model to deliver school services. This approach was selected due to its system-wide framework, emphasis on data-based measurement and individualised instruction, and the rigour of its teacher training programme. The training components are specifically designed to develop staff competencies that support the design and delivery of curricula aligned with each learner's individual level of ability. Such alignment ensures that instructional targets are achievable, but that they are also ambitious. As a system-wide model, CABAS also integrates organisational behaviour management with behaviour analysis across every level of the organisation, including learners, staff, management and parents or carers. In addition, formal links with a university support the quality of the staff training programme and promote staff engagement with research.

The core principles of behaviour, particularly those of reinforcement and motivation, are applied across the entire organisation. For example, if a learner is not engaging in a learning programme, the teacher examines which motivating factors may be influencing this lack of engagement. The same approach is applied when teachers are not engaging in staff training or understanding how to implement a learner's programme. This lack of engagement or motivation prompts consideration of potential motivating factors impacting engagement or missing prerequisite skills. The emphasis is on strategic analysis and problem-solving; identifying challenges within the system and applying the principles of behaviour to develop solutions. As Greer *et al.* (2002) highlighted, the system is interdependent, with the success of one component (for example, the learner or a member of the staff team) relying on the effective functioning of all other components. This illustrates the interconnected and interdependent nature of the CABAS model.

CABAS is a research-based model that evolves in response to shifts in practice. Its flexibility stems from its research-driven approach, which allows teachers to implement a variety of behaviour analytic tactics, and measure their effectiveness using moment-to-moment data. Teachers operate within multidisciplinary teams and also assess the impact of non-behaviour analytic strategies. The model offers scope to alter aspects of the model, the emphasis being on measurement. For example, Casarini *et al.* (2024) used a low-intensity intervention based on the CABAS model within the Italian education system and demonstrated its effectiveness. Similarly, data generated by Jigsaw School illustrates the application of CABAS within the UK context. Some of these findings have been published, contributing to the broader development of the science (e.g. Hawkins and Grant, 2011; Hawkins *et al.*, 2007, 2009, 2018; Hewett and Hawkins, 2023).

## The learners

The learners are at the centre of the CABAS model. Their progress is measured via the learn unit (Greer, 2002; Greer and McDonough, 1999) and changes in levels of verbal behaviour (Greer *et al.*, 2023). The learn unit is conceptualised as an interlocking three-term contingency between the learner and the teacher. For the learner this consists of an antecedent (this might be an instruction from a teacher such as, "Point to the cat" or seeing the word "dog"), a behaviour (the learner points to the picture of the cat or says the word "dog") and a consequence, in which correct responses are recognised and positively reinforced. This three-term contingency joins with the antecedent, behaviour and consequence for the teacher, reflecting the interdependent nature of teaching and learning within the CABAS framework.

Targets are set for learners with regard to the number of learn units achieved, ensuring there are multiple opportunities to respond during the school day. Research has demonstrated the effectiveness of the learn unit as both a measure of teaching and a means of enhancing learner performance (e.g. Bahadourian *et al.*, 2006). Targets are also set for teachers, specifying the number of learn units they are expected to present each day, making the learn unit a measure of teacher productivity as well (Greer *et al.*, 2002). In terms of levels of verbal behaviour, learners are classified as pre-listeners, listeners, speakers, readers or writers. Assessment and classification are conducted using the ELCAR (Greer *et al.*, 2023) and the Verbal Behaviour Development Assessment (Singer-Dudek *et al.*, 2023), both criterion-referenced assessment tools that inform the development of an individualised curriculum for each learner. Through progression along these levels of verbal behaviour, learners advance through their individualised curriculum, gaining increased independence as they develop.

## The teachers

Teacher performance is measured using the TPRA (Teacher Performance Rate and Accuracy; Hranchuk and Williams, 2021; Ingham and Greer, 1992; Nuzzolo *et al.*, 2025; Ross *et al.*, 2005) alongside the learn unit. The TPRA procedure ensures that learn units are presented accurately and at an appropriate rate, supporting teacher expertise. When learners do not make progress, it may reflect instructional inaccuracy rather than lack of learner ability. For example, teachers may not be presenting antecedents accurately or consistently; or they may miss opportunities to provide reinforcement, or may not follow the correction procedure accurately. Without a measurement of teacher accuracy, a learner's programme may be put on hold or incorrect tactics may be implemented to address the learning issue. In fact, the lack of learning may sit with the lack of teacher expertise. The TPRA is therefore often the first tactic applied to identify whether teaching is being implemented as planned.

During the 2024–2025 academic year, nearly 4,500 TPRA observations were conducted across the school, averaging just over 100 observations per week. This level of supervision supports the accurate implementation of targets and ensures that instructional goals are consistently met. As noted previously, these data reflect not only the accuracy of target presentation for the learners, but also reflect the development of teacher expertise in the real-time decision-making involved in curriculum delivery. The data illustrate the interdependence of CABAS components and the model's inherent self-regulatory processes.

The decision protocol (Keohane and Greer, 2005) is a core component of the CABAS model providing a structured set of rules for analysing graphed learner data and guiding timely instructional decisions. It supports appropriate pacing, prevents targets from being over- or under-run, and ensures goals remain both achievable and sufficiently challenging. The protocol includes explicit criteria for mastery, expectations for data-review frequency and a

decision-making flowchart that helps staff identify potential sources of learner difficulty, such as missing prerequisite skills, the schedule or type of reinforcement implemented or ambiguous instructional materials.

As part of the decision protocol, a TPRA is recommended in the first instance, when an overall descending trend or absence of a clear trend is anticipated. It is conducted to verify that the programme is being delivered as written and with consistency. This process allows teacher implementation fidelity to be evaluated and ruled out as a contributing factor prior to introducing additional instructional tactics or prompts, or regressing the learner to an earlier stage of instruction when such changes may not be warranted.

Data are systematically collected on both the frequency and accuracy of instructional decisions. During the 2024–2025 academic year, more than 10,000 decisions were recorded. This reflects the use of real-time, data-informed curriculum analysis, enabling instructional programmes to be advanced or accelerated at the precise point of need, rather than delayed until scheduled IEP reviews or senior staff evaluations. Teachers are trained to adhere to the decision-making protocol and to adjust the curriculum responsively based on learner performance. As a result, programmes are not unnecessarily prolonged, and additional prompts or tactics are implemented when required to support learners in meeting their objectives.

There is limited published research examining the effectiveness of the decision protocol itself, with the seminal study by Keohane and Greer (2005) representing the primary empirical evaluation to date. However, a substantial body of research has demonstrated the effectiveness of the CABAS model (as listed earlier in this paper), of which the decision protocol is a core component. More recently, Greer *et al.* (2024b) described the Accelerated Independent Learner (AIL) model, an advanced instructional framework within CABAS, in which the decision protocol is incorporated in an adapted format, illustrating its flexibility across learner profiles.

In addition, empirical research has examined the application of the same decision protocol to guide decision-making with specific interventions. For example, Frank *et al.* (2020) demonstrated the effectiveness of a decision-protocol-informed toilet training intervention for preschool-aged children with disabilities. The decision protocol informed both the initial intervention and ongoing evaluation of progress, underscoring the value of individualised instruction and objective criteria for determining when procedural adjustments are warranted.

The remaining CABAS components comprise senior school staff, parental involvement and formal university partnership. Senior staff participate in ongoing professional development to strengthen the quality of training and supervision provided to teachers. Parents receive structured outreach and training to develop competence in the application of behaviour analytic strategies at home, facilitating the generalisation of skills across settings (Yuan *et al.*, 2018). The university partnership provides external oversight and academic collaboration, helping maintain the integrity and quality of the staff training programme.

The CABAS model is fully evidence-based, with empirical research providing data and guidance for each of its component parts. The model is systematic and learner data-driven, operating as a cybernetic system in which all components interact dynamically and function in an interdependent manner. A comprehensive description of the CABAS model is beyond the scope of this paper; however, several references have been cited to provide further detail. The following section highlights the core CABAS elements that have contributed to the evidence base supporting our recognition as an outstanding provider.

## Key elements contributing to school success and learner attainment

While all components of the CABAS model have contributed to Jigsaw's overall effectiveness, three elements are considered to have been particularly influential: learn units

to criterion data, the Verbal Behaviour Development Assessment, and the staff training programme. These three areas support with precise measurement of progress, promote the acquisition of skills beyond those explicitly taught and ensure high quality instruction through the expertise and ongoing development of the teaching staff.

## Learn units to criterion

An important aspect of any education model is the establishment of educational targets that are at the correct level for each learner. Learners must come into contact with positive reinforcement to support engagement, motivation and self-esteem. Measurement of learn units to criterion data plays a central role in ensuring that instructional targets are both ambitious and achievable. Data are collected on the total number of learn units presented to each learner, and on a weekly basis this total is divided by the number of objectives met to yield an average number of learn units required for objective attainment. Values that are excessively low may indicate that instructional targets are insufficiently challenging, whereas excessively high values suggest that targets may be unachievable and that learners are not accessing reinforcement with adequate frequency. Accordingly, it is essential that teachers regularly review learn units to criterion data, engage in strategic analysis of these data and adjust curricular targets to maintain an optimal balance between challenge and achievement.

During the 2024–2025 academic year, when there were 80 learners on roll at the school, approximately 1.5 million learn units were delivered. School-wide weekly learn units to criterion data for that year ranged from 110 to 162. These data indicate that, on average, each learner received approximately 100 learn units per day and achieved a short-term objective on most instructional days.

The critical issue is not solely the apparent quality of the data themselves, but the analysis used to ensure that these data remain within an optimal range. Ongoing measurement and continuous data analysis are essential, as they support moment-to-moment instructional decisions that further refine the individualisation of the curriculum for each learner. Although the establishment of appropriately calibrated instructional targets is fundamental to all education models, there are relatively few direct measures of this process. Learn units to criterion data provide a particularly robust indicator of instructional effectiveness, as they demonstrate that a target skill was not previously in the learner's repertoire and that learning occurred as a result of systematic instruction.

## Verbal behaviour development assessment

Within the CABAS model, learners are described according to their verbal developmental stage following assessment with the ELCAR (Greer *et al.*, 2023). This assessment has always been a consistent and critical feature of the schooling model. Tools to assess learners have evolved over time from the early use of the PIRK and C-PIRK (Greer and McCorkle, 2003 (described by Hawkins and Grant (2011) and Waddington and Reed (2009)), to the development of the more up-to-date ELCAR with its integration of the Verbal Behaviour Development Assessment (VBDA; Singer-Dudek *et al.*, 2023). The VBDA has been described in detail elsewhere (Greer and Ross, 2008; Greer *et al.*, 2024a; Pohl *et al.*, 2020; Sivaraman *et al.*, 2023) and a comprehensive account is beyond the scope of this paper. The VBDA assesses for the presence or absence of multiple behavioural cusps, including generalised imitation, naming (emergent listener and/or speaker behaviour) and observational learning and the implementation of protocols to induce missing cusps.

Numerous studies conducted in CABAS schools, including Jigsaw, have contributed additional empirical data and insights to the VBDA (Hawkins *et al.*, 2018; Hewett and Hawkins, 2023; Kleinert-Ventresca *et al.*, 2023; Sun *et al.*, 2024; Yoon *et al.*, 2023). Each new publication informs iterative refinements to the assessment tool, including the

development and testing of protocols for inducing behavioural cusps. Existing protocols are updated as ongoing research expands the evidence base and enhances the effectiveness of the assessment.

The original PIRK was primarily a skills-based assessment. In contrast, the updated ELCAR retains this skills-based focus while also encompassing a broader assessment of behavioural cusps, capturing learners' capacity to acquire skills beyond those directly taught. This approach emphasises developmental stages rather than discrete skills alone, providing a more comprehensive measure of a learner's learning potential.

The VBDA is an assessment and curriculum guide that enables the teaching team to identify potential barriers to learning that may impede learner progress. This assessment promotes a macro-level analysis of learning challenges, rather than a solely micro-level focus on individual skills. For example, if a learner encounters difficulty discriminating between colours, additional prompts or instructional tactics may be introduced to support the skills, and successful prompts are subsequently faded. There are instances, however, where repeated prompting or the layering of multiple tactics fails to produce mastery. The VBDA guides the teaching team to address the underlying barrier to learning. For example, the learner may have a deficit in listener skills, prompting the implementation of a protocol designed to induce listener literacy (e.g. the listener emersion protocol; Greer *et al.*, 2005; Kim *et al.*, 2020). Once listener literacy is established, instructional programmes targeting listening can be re-introduced, with learners typically demonstrating progress. This approach illustrates that the difficulties may lie with a broader, foundational skill area, and it is this that needs to be addressed.

A central focus of the VBDA, and therefore of each learner's curriculum, is the promotion of emergent behaviour, which supports the overarching goal of enabling learners to acquire skills beyond those that are directly taught. This approach emphasises efficient instruction and the facilitation of faster learning in new ways. One example of a behavioural cusp is naming, which occurs when a learner acquires the names of new items through naturalistic learning experiences. The achievement of such behavioural cusps represents a developmental milestone that allows learners to acquire new skills more efficiently and flexibly. The VBDA provides a systematic framework for evaluating the presence or absence of behavioural cusps, and for implementing targeted protocols to induce missing cusps. Once established, these cusps enhance instructional efficiency and enable learners to generalise learning beyond directly taught content. Consequently, curriculum planning and delivery are continually refined with a focus on promoting efficient learning and maximising learner outcomes.

## Staff training programme: CABAS ranks

The staff training programme within a CABAS setting is both intensive and comprehensive. Reflecting on the school's progress over the past 25 years, this programme has been a major factor contributing to its success. Empirical research demonstrates a strong correlation between staff expertise and learner outcomes (Du and Lee, 2024; Greer, 1997), a relationship that has been consistently observed within our setting. Staff are highly motivated to deepen their knowledge of behaviour analysis and are encouraged to engage in applied research within the school. This culture of professional engagement fosters continuous data analysis, problem-solving, and systematic evaluation of interventions, ensuring that instructional decisions are evidence-based and outcomes-focused.

Within the CABAS model, staff have access to eleven hierarchical ranks, providing structured opportunities for ongoing professional development and the progressive enhancement of expertise. Two ranks are designated for teaching assistants, with a primary focus on classroom teaching, while three teacher ranks are available, culminating in the

Master Teacher rank, which emphasises applying instructional tactics to support and develop the skills of the broader staff team. Staff in supervisory roles are generally expected to progress to this Master Teacher level.

Beyond the teaching ranks there are three research scientist and three behaviour analyst ranks, each oriented toward research activities, including journal publications, conference presentations, peer mentoring and the refinement of processes within the CABAS model. The teaching ranks encompass three distinct repertoires: verbal behaviour about the science, contingency-shaped and verbally-mediated. Each rank comprises multiple components, for example the CABAS Teacher 1 rank consists of 79 components. Definitions of each repertoire and examples of their coverage across some of the CABAS teaching ranks are presented in Table 1.

To illustrate the application of the teaching ranks in practice, a teacher may study backward chaining as part of the verbal behaviour repertoire, then demonstrate its implementation within the contingency-shaped repertoire, and subsequently engage in analysis as part of the verbally mediated repertoire. This analytical process may involve reviewing relevant journal articles on backward chaining, examining classroom data reflecting its implementation or conducting a research project to evaluate the effectiveness of the tactic.

Staff members are encouraged to engage in research as an integral component of their teaching ranks. Most projects use single case experimental designs to examine the impact of specific instructional tactics on individual learner's rate of learning. Some studies use more rigorous experimental designs, such as multiple baseline or changing criterion designs, and several have been published in peer-reviewed journals (e.g.,

**Table 1** A description of each of the repertoires within the CABAS® ranks with examples

| *CABAS® ranks* | *Verbal behaviour about the science* | *Contingency-shaped* | *Verbally mediated* |
|---|---|---|---|
| Description of repertoire | The theory of behaviour analysis, learning the technical terminology and broadening staff knowledge on the number of different tactics and strategies that are available to support with learning | The application of behaviour analysis and all of the relevant tactics to the classroom | The analysis of data, problem-solving and seeking solutions to support with learning |
| Example | Reading behaviour analytic texts and completing quizzes related to the content | In-situ supervision in the classroom with targets set for individual teachers based on learn unit presentation, TPRA accuracy and decision protocol accuracy. The TPRA accuracy includes demonstrating the use of the different tactics | Reading journal articles related to different tactics and conducting research in the classrooms by applying tactics and demonstrating whether they are effective or not |
| Example CABAS® teaching assistant rank component | To complete 'Introduction to Learn Unit' quiz to 90% mastery criterion | To accurately present instruction across five different programmes for one learner (as measured by 5 errorless TPRAs) | To accurately graph instructional data for one learner across 10 programmes with 100% accuracy |
| Example CABAS® Teacher 1 Rank Component | To complete 'Scientific Designs' quiz to 90% mastery criterion. The text to read for this quiz is Cooper *et al.* (2020) chapters 8–10 | To accurately present speaker instruction to learners (as measured by 10 errorless TPRAs) | To complete an entire ELCAR assessment and identify and select appropriate curricular goals based on the ELCAR assessment for one learner |
| CABAS® Teacher 2 Rank Component | To complete 'Inducing Listener Capabilities' quiz to 90% mastery criterion. The text to read for this quiz is Greer and Ross (2008) chapter 3 | To be accountable for 10 objectives achieved for 2 learners with learn units to criterion appropriate for each learner's level of verbal behaviour | To complete 2 correct strategic analyses of the problem within the context of the learn unit and selection of appropriate tactic |

Hawkins *et al.*, 2007, 2009, 2011, 2018, 2022, 2025; Hewett and Hawkins, 2023). Senior staff are further encouraged to collaborate with other researchers external to the school, providing an additional layer of peer review beyond that offered by the publication process itself (e.g., Locke and Fennell, 2024; May *et al.*, 2013). Publishing research offers three key benefits: it highlights the impact of Jigsaw's work; it contributes empirical data that supports the ongoing development and refinement of the CABAS model; and it provides a platform to disseminate effective practices to the broader educational and professional community.

Over 25 years, 63 individuals at Jigsaw have completed a Master's qualification in behaviour analysis, and 190 CABAS ranks have been attained by staff at the school. This component of the CABAS model has made a substantial contribution to school improvement, yielding a positive and sustained impact on learner outcomes. These gains are attributable to enhanced staff expertise, systematic data analysis and a strong engagement with research-informed practice. In addition, access to structured professional training has contributed positively to staff retention. Staff report high levels of motivation to engage in learning and collaborative problem-solving, and value the opportunity for ongoing professional development.

## Conclusions

Several components of the CABAS system are clearly transferrable to other pedagogical models. In particular, educators should give careful consideration to the measurement of instructional targets to ensure they are both ambitious and attainable, as well as strategies that promote learner generalisation beyond explicitly taught skills. The evidence further indicates that high quality staff training has a substantial and positive impact on learner outcomes. Maintaining a workforce that is informed by current research enables the model to remain responsive and to evolve over time. Within the CABAS model, staff engagement with research is systematically supported through progression in teaching ranks, ensuring that emerging evidence is embedded within routine practice. Overall, the integration of evidence-based systems such as CABAS, alongside a sustained commitment to professional development, provides a robust framework for enhancing educational outcomes. Continued reflection and active engagement with research are essential to support the ongoing development of effective practice.

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