LIVERPOOL JOHN MOORES UNIVERSITY

LJMU Research Online

Martin, P, Thorpe, P, Ware, J, Goldbart, J, Denovan, A, Dagnall, N and Bradshaw, J

Academic progress in learners with profound intellectual disabilities: analysis of a Routes for Learning dataset

https://researchonline.ljmu.ac.uk/id/eprint/26734/

Article

Citation (please note it is advisable to refer to the publisher's version if you intend to cite from this work)

Martin, P, Thorpe, P, Ware, J, Goldbart, J, Denovan, A ORCID logoORCID: https://orcid.org/0000-0002-9082-7225, Dagnall, N and Bradshaw, J (2025) Academic progress in learners with profound intellectual disabilities: analysis of a Routes for Learning dataset. European Journal of Special

LJMU has developed **LJMU Research Online** for users to access the research output of the University more effectively. Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. Users may download and/or print one copy of any article(s) in LJMU Research Online to facilitate their private study or for non-commercial research. You may not engage in further distribution of the material or use it for any profit-making activities or any commercial gain.

The version presented here may differ from the published version or from the version of the record. Please see the repository URL above for details on accessing the published version and note that access may require a subscription.

For more information please contact researchonline@ljmu.ac.uk

http://researchonline.ljmu.ac.uk/

European Journal of Special Needs Education

ISSN: 0885-6257 (Print) 1469-591X (Online) Journal homepage: www.tandfonline.com/journals/rejs20

Academic progress in learners with profound intellectual disabilities: analysis of a Routes for Learning dataset

P. Martin, P. Thorpe, J. Ware, J. Goldbart, A. Denovan, N. Dagnall & J. Bradshaw

To cite this article: P. Martin, P. Thorpe, J. Ware, J. Goldbart, A. Denovan, N. Dagnall & J. Bradshaw (03 Jul 2025): Academic progress in learners with profound intellectual disabilities: analysis of a Routes for Learning dataset, European Journal of Special Needs Education, DOI: 10.1080/08856257.2025.2524972

To link to this article: https://doi.org/10.1080/08856257.2025.2524972

© 2025 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

Published online: 03 Jul 2025.

Submit your article to this journal

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at https://www.tandfonline.com/action/journalInformation?journalCode=rejs20

EUROPEAN JOURNAL OF SPECIAL NEEDS EDUCATION
https://doi.org/10.1080/08856257.2025.2524972

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Academic progress in learners with profound intellectual disabilities: analysis of a Routes for Learning dataset

P. Martin[a], P. Thorpe[b], J. Ware[c], J. Goldbart[d], A. Denovan[d], N. Dagnall[d] and J. Bradshaw[e]

[a]Independent scholar; [b]Engineering, Gulmay Ltd, Byfleet, UK; [c]School of Education, Bangor University, Bangor, UK; [d]School of Psychology, Manchester Metropolitan University, Manchester, UK; [e]Intellectual Disabilities Research Institute, University of Birmingham, Birmingham, UK

ABSTRACT

Routes for Learning (RfL) is a Welsh-English assessment tool designed to provide formative and summative assessment for learners with Profound and Multiple Learning Disabilities (PMLD). The assessment uses a 'Routemap' consisting of 43 approximately developmentally ordered 'boxes' (assessable competencies, such as contingency awareness) with no assumption of linear progress.) This study uses data from RfL to examine learners' trajectories and progress over time. The data came from a special school which had assessed learners annually over 13 years. Routemap boxes were ordered by averaging over individual learner trajectories and comparing this with the partial ordering of boxes implicit in the Routemap. Distributions of the number of boxes gained by a single learner in a year were derived. The probability of a learner gaining at least one box in a year was calculated. Analysis of the order in which individual learners achieved Routemap Boxes was largely consistent with the partial ordering of the Routemap. Progress was demonstrated across all age groups, in almost all learners. RfL can demonstrate both progress and regression. The value of longitudinal electronically recorded data is highlighted. The time taken to achieve boxes and sequence followed shows some variation among learners, supporting the appropriateness of the non-linear model of progress adopted by RfL.

ARTICLE HISTORY
Received 17 December 2024
Accepted 20 June 2025

KEYWORDS
Profound intellectual disability; PMLD; PIMD; Routes for Learning; academic progress; assessment

Introduction

Children with profound intellectual disability (ID) 'present with a diversity of intellectual, physical, sensory and communicative impairments' (Lyons and Arthur-Kelly 2014, 445). They will experience profound cognitive impairment and be operating at a very early developmental level. In addition, their difficulties commonly include visual impairments (van Splunder et al. 2006), hearing loss (Kerr et al. 2003), limited or no comprehension of speech and communication at pre-symbolic or proto-symbolic levels (Dhondt et al. 2020; Iacono et al. 2009), epilepsy (van Timmeren et al. 2017) and chronic pain (McGuire, Daly, and Smyth 2010). The increased prevalence of additional disabilities experienced by these children has led to the use, particularly

CONTACT J. Ware j.ware@bangor.ac.uk

© 2025 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (http://creativecommons.org/licenses/by-nc-nd/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

by education, health and social care providers, of descriptive terms such as 'profound and multiple learning difficulties (PMLD)' and 'profound intellectual and multiple disabilities' (PIMD). The data in the present paper are presented with reference to the acronym PMLD, because this is the classification used by the education system operating in Wales and England, and the school within which the study was conducted.

Although most countries are signatories to both the UN Convention on the Rights of the Child (1989) and the UN Convention on the Rights of Persons with Disabilities (2006), the acceptance that children with profound ID are educable has been gradual. In Sweden, education became mandatory for all children in 1968 (e.g. Grunewald 2009), in England and Wales the 1970 Education Act, gave every child the right to education. This right has been achieved more recently in other jurisdictions, (e.g. Poland 1997 (Aksamit and Wheeler 2021), South Africa 2011, (McKenzie 2021)).

The developmental level and additional needs of children with profound ID imply a need for a significantly differentiated educational curriculum (Imray, Kossyvaki, and Sissons 2023; McKenzie 2021) and appropriate approaches to assessment (Smith, Critten, and Vardill 2020). Since the transition of children with profound ID into compulsory education, education and allied health professionals have developed assessment and curriculum approaches designed to meet the needs of learners functioning within the first 2 years of typical development. These have included assessments grounded in typical developmental trajectories and adapted to the additional needs of those with profound disabilities (e.g. ECP: Evaluation – Cognition – Polyhandicap (Poujol et al. 2021; Scelles 2017), Behavior Appraisal Scales (BAS; Vlaskamp, van der Meulen, and Smrkovsky 1999)), those designed for autistic children (e.g. Childhood Autism Rating Scale, 2nd Edition, Schopler et al. 2010) or developed by schools for their own use (Kontu and Pirttimaa 2008). Wessels, Putten, and Paap (2021), however, surveying professionals in the Netherlands, Germany and the United Kingdom, found that almost 80% were using assessments not designed for learners with PIMD.

The primary uses of assessment in educational contexts are summative and formative (e.g. Harlen and James 1997), where the former looks retrospectively at what has been attained and the latter is designed to inform future teaching and learning. One approach, specifically designed for educational settings, to capture pupil progress in relation to the 1988 National Curriculum for England, Wales and Northern Ireland, was the Performance Scales (P scales) which were published in 1998 and revised in 2001 (Department for Education and Employment and Qualifications and Curriculum Agency 2001). The P scales are a summative assessment providing a detailed set of 'best fit' descriptors, identifying linear progression within National Curriculum subjects below Level One (the level expected of typically developing pupils aged 5). Their use was mandatory in the State sector in England from 1999 to 2021, allowing an analysis of progress over time in children with a range of disabilities (Ndaji and Tymms 2010).

Ndaji and Tymms (2009, 2010) conducted a Rasch analysis of data from 22,506 pupils with moderate, severe and profound ID. Although older pupils were expected to achieve higher P Scale Scores this pattern was not found for pupils with PMLD where there was little difference between the scores of younger and older groups. For all groups, the most progress was shown before ages 10–11. There appear to be no other data which analyse the developmental progress of school age learners with profound ID.

Despite their potential utility in assessing progress, the P scales have been criticised for an apparent underpinning assumption that children with profound ID will make linear progress through their school career (Lacey and Jeanette 2015) though this criticism is disputed by Fergusson and Richard (2015). The apparently limited linear progress made by learners with PMLD has led educationalists to conceptualise lateral or non-linear progression (Hogg 2017; Rendoth, Duncan, and Foggett 2021; Welsh Assembly Government 2006) as more relevant for this group of learners. The value of the P-scales was further challenged in the Rochford review (Rochford 2016), because the report's contributors found some schools using the assessment as a curriculum, thus narrowing children and young people's learning opportunities.

Following the Rochford review, the use of the P-scales in schools in England has been replaced by the Engagement Model (Standards and Testing Agency 2020) (for P1–4) and the pre – Key Stage Standards (for P 5–8). The Engagement Model was devised for use with autistic children (Carpenter et al. 2016) and there appears, to date, to be no research on its appropriateness or use with learners with profound ID. Concerns have been expressed by Aidonopoulou-Read (2021) and Hinchcliffe (2022), who identify limitations in the capacity of the Engagement model to provide summative assessment. This seems to have been accepted by the Department for Education's Standards and Testing Agency (2020) in that they propose that The Engagement Model 'should be used in conjunction with the assessment systems that a school is already using'. p.16.

One assessment designed to provide both formative and summative assessment, and to assess lateral as well as linear progression, is Routes for Learning (RfL, Welsh Assembly Government 2006; Welsh Government 2020a); a Welsh-English assessment tool designed specifically for learners with PMLD. It is informed by stages and sequences in typical development, but particular attention is paid to the potentially different developmental trajectories of learners with sensory and physical impairments in addition to profound intellectual disabilities. The 2006 edition included an assessment booklet, a Routemap poster demonstrating assessment items (see Figure 1) and possible routes between them, additional written guidance and a DVD demonstrating exemplar behaviours.

The original version of the assessment (Welsh Assembly Government 2006) comprised 43 items, ('boxes'), addressing communication and interaction, cognition and learning and interaction with the environment. The layout of the Routemap implies a 'partial ordering' of the boxes, in that those towards the top of the map represent less developmentally advanced behaviours than those shown further down. Thus, learners may be expected to demonstrate achievement of the earlier boxes before those which appear subsequently on the Routemap. However, there is no expectation of linear progress, and many possible routes through the assessment are indicated on the Routemap.

The Routemap includes certain key milestones drawn from typical infant development (the 'orange' boxes) through which every learner is thought likely to pass. However, key to its design is the principle that individual learners are likely to follow very different 'routes' through the Routemap. Thus, RfL aims to capture non-linear, lateral progression as well as, more traditional, linear progress.

Before publication, the RfL materials were trialled in 15 schools across Wales (Donnelly 2005). Donnelly reported that the response to the materials was very positive overall. Schools felt that, unlike other materials available, they took account of sensory and

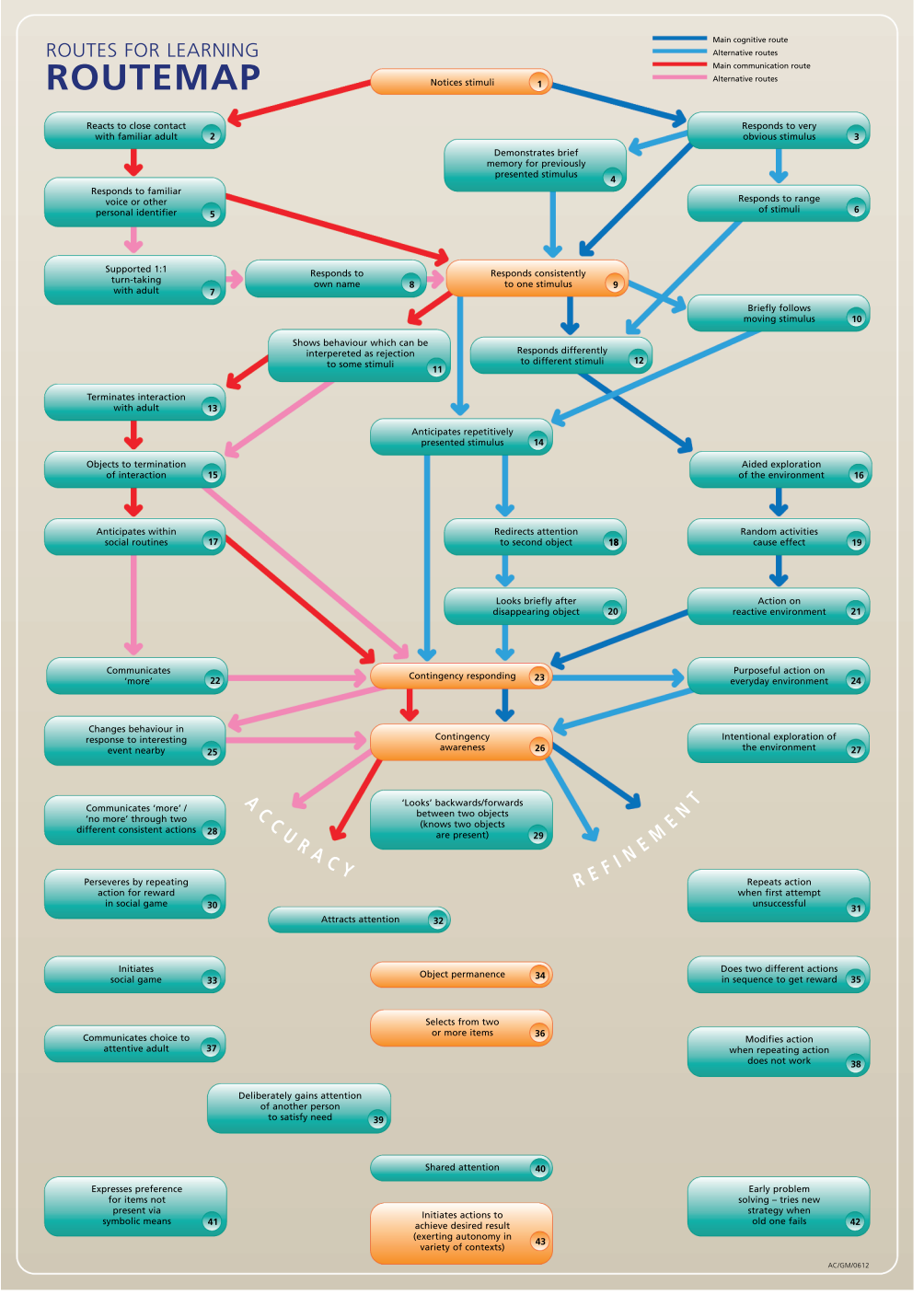


Figure 1. Routes for Learning Routemap - original (2006) edition.

physical impairments. Many schools found the materials useful in pin-pointing learners' current developmental levels. This 'enabled them to move on learners who had become "stuck" and target more appropriate/relevant learning outcomes across the curriculum' (Donnelly 2005).

There has been some, primarily qualitative, evaluation of the implementation of RfL. Weston and Ware (2018) surveyed 321 specialist schools in England and 39 in Wales, which were thought to educate children with PMLD. Responses were received from 57 schools using RfL and 15 that were not. Reported advantages of RfL were the small achievable steps, appropriate for learners with PMLD, the flexibility of the assessment which reflected the idiosyncrasy of learning in learners with PMLD, the opportunity to set targets and track progress, and the guidance provided to staff. These findings broadly supported those of single-location studies by Van Walwyk (2011) and McDermott and Atkinson (2016). Authors of all studies agreed that the lack of an electronic recording system limited the usefulness of RfL for school-level reporting and using the data for school improvement. However, Weston and Ware report that all but two of those schools in Wales, who were using RfL, did use summative data from the assessment to inform school improvement, as did 25% of those in England.

Thus far, research on RfL addresses implementation and teachers' perspectives, but not whether children with PMLD make progress over time or whether the layout of the Routemap corresponds to the order in which learners achieve boxes. The availability of an anonymised dataset from one school over an extended period made it possible to address these issues.

Research data

The researchers were granted access to anonymised data from the school records as listed in Table 1. No permission was given for the publication of any other data about the learners. The data consist of records of all RfL assessments made by the school during the period. The school used RfL when it was thought to be the most appropriate assessment for the learner.

The data was gathered over a 13-year period from 67 learners in an all-age (3–19) special school in South Wales, generating 338 assessments.

Research questions

(1) Was the data from one group of learners with profound ID consistent with the partial ordering of Routemap boxes implicit in the layout of the Routemap?

Table 1. Items in each record.

Learner ID	A number allocated when the learner joins the school
Year Group	The year group the learner was in when the assessment was made (see Table x)
Date	The day on which the assessment was made
Achievements	A list of 43 booleans indicating whether or not the learner had achieved the Routemap box with the corresponding number

Table 2. Relationship between school years, Key Stages and chronological age (Wales).

Year group	Key stage	Chronological age
N1	Foundation Phase	2–3
N2		3–4
R		4–5
Y1		5–6
Y2		6–7
Y3	Key Stage 2	7–8
Y4		8–9
Y5		9–10
Y6		10–11
Y7	Key Stage 3	11–12
Y8		12–13
Y9		13–14
Y10	Key Stage 4	14–15
Y11		15–16
Y12	Post-16	16–17
Y13		17–18
Y14		18–19

N1 and N2: learners attended part-time (morning or afternoon).
N1 (until 2013): learners started school in the term following their third birthday.
N2 (after 2013): learners started school in the September following their third birthday.

(2) Did learners demonstrate progress on the RfL assessment and if so, was progress demonstrable across year groups? (See Table 2).

Method

Creation of dataset

The school had played a significant role in developing and piloting the RfL materials. Following their publication all staff received further training. Teachers regularly collected video examples of the school's own learners and jointly considered which Routemap boxes the clips illustrated. This process helped to develop consistency when assessments were subsequently undertaken.

In Autumn 2006, baseline data was collected of learners' achievements on the Routemap. This data consisted of teachers' judgements of the boxes achieved by individual learners, with the evidence on which those judgements were based, quality assured through discussion with the head teacher. In January 2007, the baseline data was entered into a computer-based recording system created by the headteacher, using MS Access 2003.

Technical details of the database can be found in supporting information. The anonymised dataset can be accessed via the first author.

The database was named *EnRoute*, which was intended to convey its primary purpose: to show the progress made by individual learners as they followed their own learning pathways through the Routemap. All teachers were trained to use *EnRoute*. Throughout the school year, they used it to record evidence, to inform their decisions about next steps for individual learners and, by viewing the evidence recorded by other teachers, to learn how other learners in the school were

demonstrating the behaviours described in Routemap boxes and in what (curriculum) contexts thereby increasing consistency of judgements.

In each summer term between 2007 and 2019, teachers submitted their judgements about Routemap boxes, through *EnRoute*. Judgements were confirmed only after a discussion had taken place between each teacher and the school's assessment coordinator. Each pupil and Routemap box were discussed focusing on the range and quality of the evidence collected throughout the year as well as the degree to which what was presented matched criteria set out in the RfL Assessment Booklet. Confirmed judgements were then entered into *EnRoute* which presented this information for each learner, showing the baseline and subsequent annual assessments. Thus, reliable data was available showing the year in which each Routemap box was achieved by each learner. The dataset captured both the calendar year and the school year (N1 to Y14. See Table 2 for a list of school years and Key Stages as they applied in Wales during the period of data collection).

As can be seen in Figure 2 only two learners have data for the baseline and all 13 years during which data was collected. Learners might have had an incomplete assessment record for a variety of reasons:

- RfL was only used for learners for whom it was agreed to be the most appropriate assessment available. As soon as any learner completed all, or almost all items on the Routemap, they began to be assessed by other means and so ceased to be represented in the dataset (seven learners).
- Some learners left the school earlier than Y14 (five learners);
- Some learners joined the school in a school year other than N1 or N2;
- Some learners were absent from school for a prolonged period.

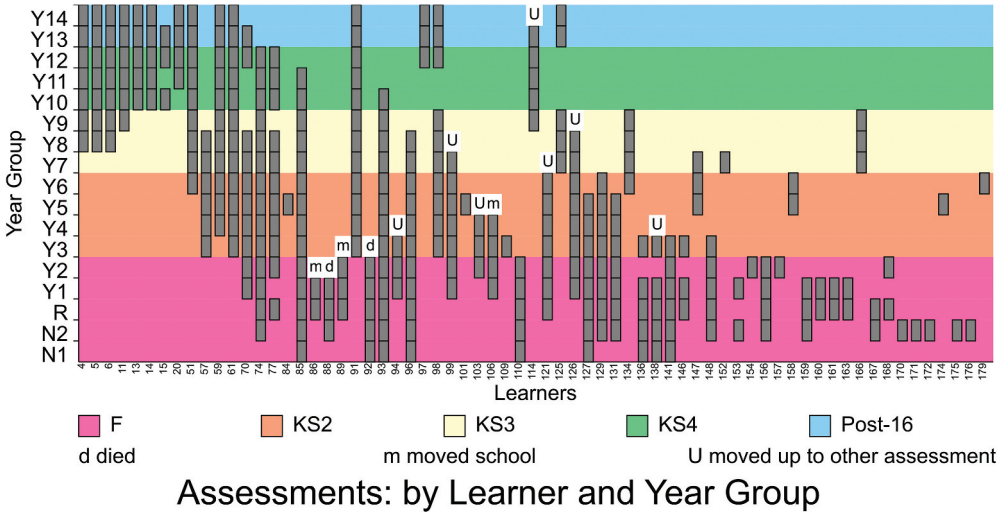


Figure 2. Assessments used: by learner and year group.

Ethical scrutiny and approval

In September 2019, a request was made to the school's governing body seeking permission to examine and analyse anonymised data held in the *EnRoute* database. The governing body kindly agreed, and a copy was taken of the data file. Only information relating to learners' progress on the Routemap was included in this file. Individual learner records could be distinguished by a unique number but all other reference to individual learners and teachers was carefully removed from the data, ensuring that neither learners nor teachers could be identified. The research received ethical approval from Manchester Metropolitan University Faculty of Health, Psychology and Social Care Faculty Research Ethics Committee University EthOS reference number 15,995.

The detailed method, results and preliminary discussion of RQ1 and RQ2 are presented separately below.

RQ1: Sequence of acquisition of boxes

The order in which the boxes are acquired by a group of learners has not previously been investigated. RQ1 attempted to address this.

Analysis method (RQ1)

If at a review point, a learner was assessed as having achieved box i but not box j, that learner achieved box i before box j. A(i, j) is the number of such learners in the data.

D(i,j) is the difference between the number of learners who achieved box i before box j (A(i, j)) and the number of learners who achieved box j before box i (A(j, i))

If all learners followed the same sequence of boxes A(i, j) > 0 would imply A(j, i) = 0, but for many cases neither A(i, j) nor A(j, i) are zero, showing that learners followed different sequences.

N(i) is the position of box i in a sequence of box numbers.

The objective of the analysis was to find all sequences such that if N(i) is less than N(j) then D(i, j) is greater than or equal to zero.

For a valid sequence, interchanging N(i) and N(j) will give an invalid sequence unless D (i, j) = 0. However, if D(i, j) = 0 and i and j are adjacent, interchanging N(i) and N(j) gives a valid sequence, so there may be multiple valid sequences.

Results (RQ1)

Valid sequences of box numbers exist and are as follows:

1, 3, 2, 6, 4, 5, 9, 7, 10, 11, 12, 16, 13, 14, 21, 8, 18, 17, 23, 22, 20, 24, 25, 29, 27, 28, 31, 32, 30, 36, 37, 34, 39, 33, 35, 38, 40, 42, 41, 43

with

(1) inserted anywhere from before 13 to after 14,
(2) inserted either before or after 25,
(3) inserted anywhere from before 30 to after 37.

Figure 3 shows the Routemap as published in 2006, with lines linking each box to the ordering indicated by the data analysis above. The orange boxes represent key developmental milestones, other boxes are shown in green as in the Routemap (see Figure 1).

RQ2: Can RfL demonstrate progress?

Analysis method (RQ2)

To examine whether learners made progress according to their assessment on RfL, it was necessary to aggregate data for all learners who were in a particular school year at any point during the 13 years for which data is available. Since the earliest school year in which learners can enter the school is N1, the first school year in which progress can be assessed is N2. Of the 67 learners, 54 had assessments for at least two consecutive years.

Figure 4 shows that in each school year, with the exception of N2 and R, there are some learners for whom there is no assessment although they were assessed in each of the previous 2 years (white boxes). There are also some learners who have had an assessment in the current and previous school years, although they were not assessed in the year before that (yellow boxes). Consequently, the mean start level for a year group is not necessarily the same as the mean end level for the previous year group. As indicated above, learners entered and left the school and some progressed to other assessments.

Figure 5 shows data by year group, averaging over all learners for whom we had assessments at the beginning and end of that year. We can therefore deduce the mean number of boxes gained (or lost) in the year. For an individual learner, the total number of boxes achieved may increase or decrease. This means that using mean achievement levels at time points did not measure progress and can show regression when all learners being assessed were progressing. We therefore used boxes gained in a learner-year as the statistic on which to base our analysis. Options for analysis are limited because we have no model for the distribution of boxes gained.

Results RQ2: did RfL detect change?

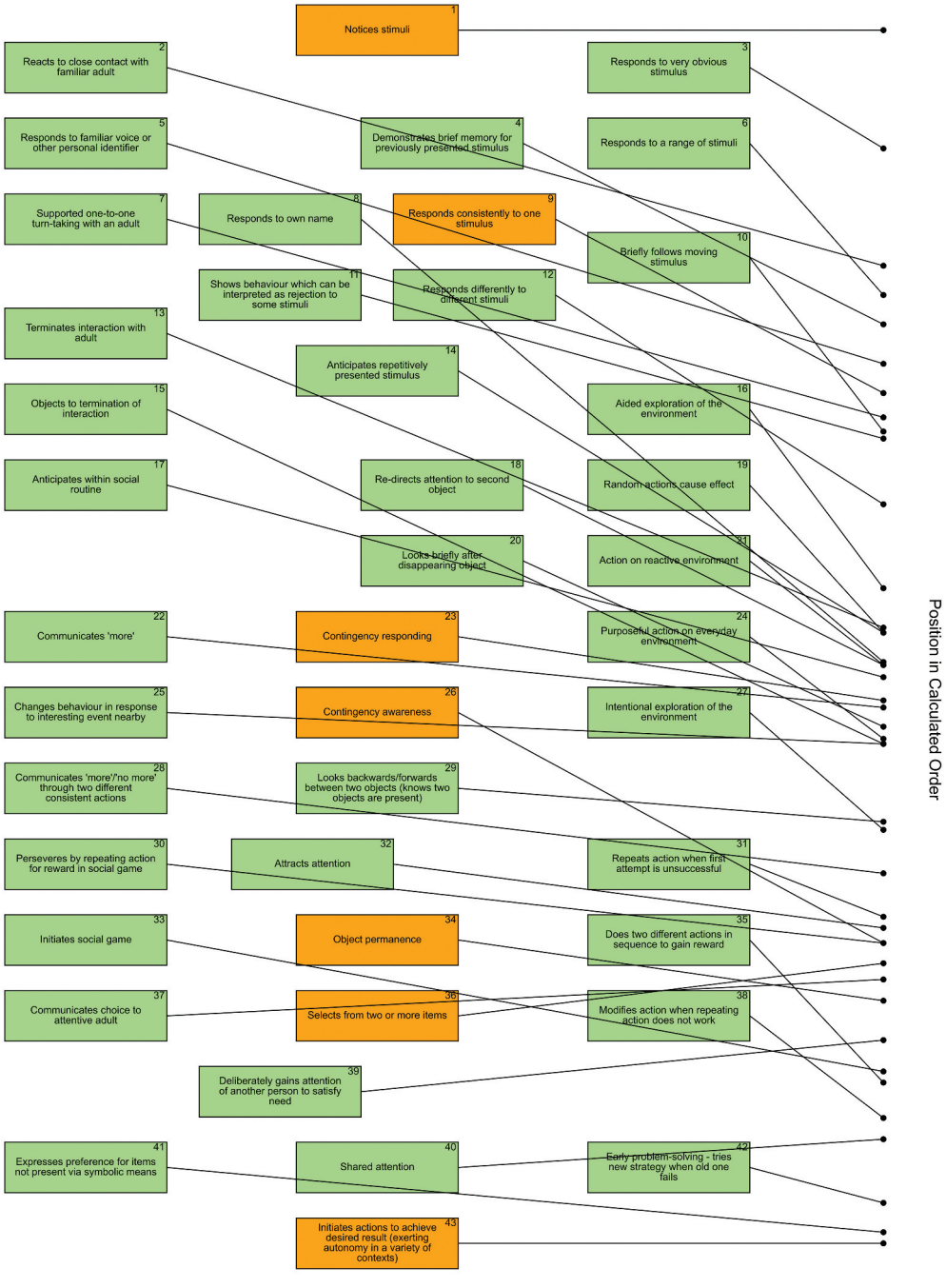
Figure 6 shows the distribution of boxes gained in a year for each Key Stage.

We present two techniques for showing that RfL can demonstrate progress. The first tests for the mean number of boxes gained in a year by a learner being greater than zero. The second tests for probability of a learner gaining at least one box in a year being greater than some non-zero value.

We have an estimate for the mean gain of boxes in a learner-year, but we need an estimate for its variance to be able to obtain a p value. We may assume that the mean gain is normally distributed as it is derived by adding tens of samples. Given the variance of the boxes gained in a learner-year we can deduce the variance of the mean by dividing by $\sqrt{n}$, the number of samples used.

Our first estimate for the SD of a single gain is that it is guaranteed to be less than the SD of the distribution of the gains (See Table 3).

We can invert the question and ask what the implication is for the SD of the gain in a learner-year if the confidence level is less than a given value (See Table 4).



Spacing shown between consecutive boxes in the new ordering is proportional to D(N(i), N(i+1)) / (A(N(i),N(i+1)) + A(N(i+1),N(i))).
Roughly, the greater the distance between points, the more confidence we can have in their order.

Box Ordering from RQ1 Analysis

Figure 3. Box ordering from RQ1 analysis.

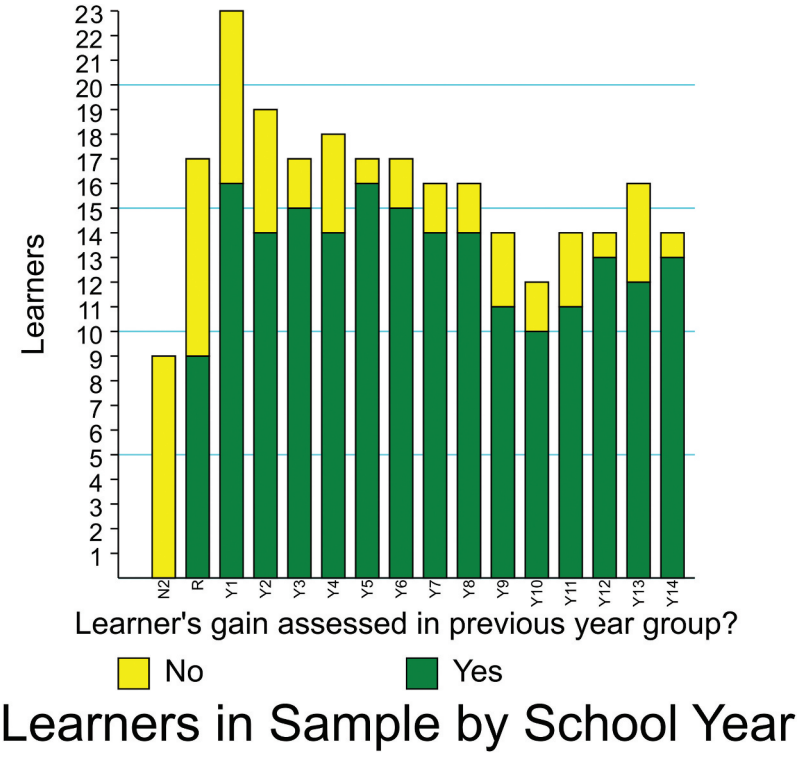


Figure 4. Learners in sample by school year.

These calculations give convincing evidence for detecting progress with RfL for all but the Post-16 group. However, consideration of the methods used to assess the gain in a learner-year might suggest that the SD of the distribution of a single sample is unlikely to as great as 1, which would give much better than 99% confidence even for the Post-16 group.

Alternatively, from our data, we can estimate the probability of learners progressing in a year at each key stage. We can also take a lower probability and calculate the probability of obtaining our results if the actual probability is that figure or higher.

This is equivalent to getting at least n heads from t tosses of a biased coin with probability of p of coming down heads. The number of heads from a given number of tosses has a binomial distribution that can be calculated exactly. As it uses a likelihood ratio test, it is the most powerful test available. Using a Chi^2 method gives a very slightly weaker result but does not affect the conclusions (See Table 5).

Change

The second method can also be used as a test for demonstrating change. In a few cases, learners regress in a year so the statistics are slightly stronger (See Table 6).

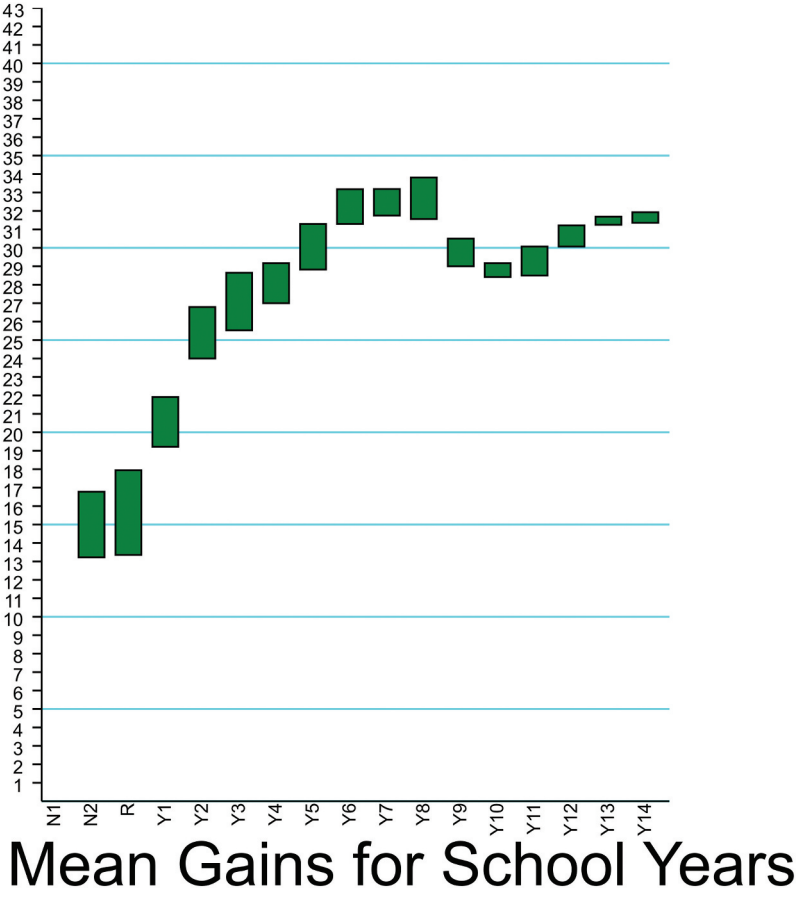


Figure 5. Mean gains for school years.

Table 3. Means and standard deviations of gains by Key Stage.

Stage	Samples	Mean	SD	SD of Mean	Mean in SDs	Tail
Foundation Phase	68	3.5	2.50	0.305	11.5	<0.0001
Key Stage 2	69	2.4	2.43	0.295	8.1	<0.0001
Key Stage 3	46	1.8	2.64	0.394	4.6	<0.0001
Key Stage 4	40	1.2	1.55	0.248	4.8	<0.0001
Post-16	30	0.5	1.52	0.283	1.8	0.035

Table 4. Standard deviations for given levels of significance.

Stage	Samples	Mean	SD	SD for $p < 0.05$	SD for $p < 0.01$	SD for $p < 0.001$
Foundation Phase	68	3.5	2.50	17.75	12.35	9.16
Key Stage 2	69	2.4	2.43	12.40	8.63	6.40
Key Stage 3	46	1.8	2.64	7.56	5.26	3.90
Key Stage 4	40	1.2	1.55	4.59	3.19	2.37
Post-16	30	0.5	1.52	1.68	1.17	0.87

Table 5. Significance levels by Key Stage: progress.

Stage	–	0	+	p Progress	Min p	Tail
Foundation Phase	0	5	63	0.93	0.8	0.0037
Key Stage 2	0	17	52	0.78	0.6	0.0055
Key Stage 3	2	9	35	0.76	0.55	0.0026
Key Stage 4	0	18	21	0.54	0.33	0.0058
Post-16	2	16	12	0.40	0.2	0.0095

Table 6. Significance levels by Key Stage: change.

Stage	–	0	+	p Change	Min p	Tail
Foundation Phase	0	5	63	0.93	0.8	0.0037
Key Stage 2	0	17	52	0.78	0.6	0.0055
Key Stage 3	2	9	35	0.80	0.55	0.0026
Key Stage 4	0	18	21	0.54	0.33	0.0058
Post-16	2	16	12	0.47	0.25	0.0082

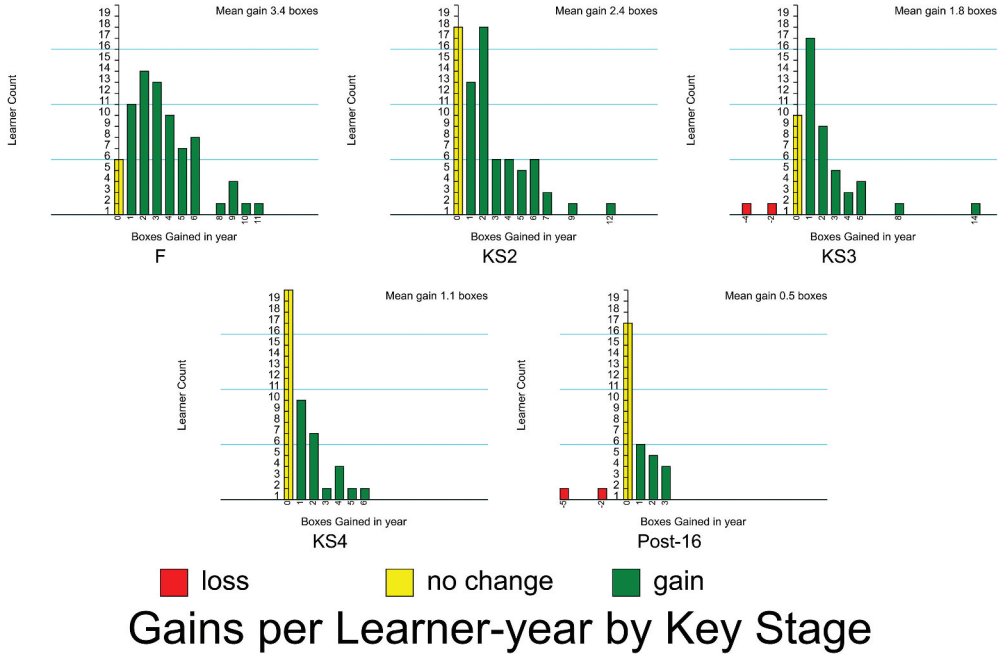


Figure 6. Gains per learner-year by Key Stage.

Discussion

RQ1: *Sequence of acquisition of boxes*

The sequence analysis broadly followed the Routemap, with the exception of Box 8 ('responds to own name') which appears much later in the analysis. This confirms

anecdotal reporting by teachers using RfL; consequently, Box 8 has been removed from the revised materials (Welsh Government 2020b).

The data came from a school which had been involved in the design of the materials and where there was a high degree of collaboration between the various members of staff involved in assessment. Nevertheless, the actual sequence of boxes achieved differs to some extent between learners (see Figure 3). This may have reflected the part played by sensory and motor impairments in the development of individuals with PMLD (Lyons and Arthur-Kelly 2014), supporting the view that the progress of this group of learners was not linear, and thus assessments and by implication, teaching, which assume linear progress are not well suited to learners with PMLD as argued by Lacey and Jeanette (2015). It also supports the idea of lateral or non-linear progression suggested by authors such as Hogg (2017) and Rendoth, Duncan, and Foggett (2021) as more relevant for this group of learners. Whilst variability in sequences of boxes achieved is potentially of significance for teaching, further research is necessary.

RQ2: *Can RfL demonstrate progress?*

The analysis above showed that RfL was able to demonstrate change in number of boxes achieved by learners, regardless of whether this was an increase or decrease. Progress over time was shown for all Key Stages. This suggests that, compared with the P Scales (Ndaji and Tymms 2009), RfL is better able to demonstrate the progress of learners with PMLD.

The average number of boxes achieved in the course of a year, however, decreased with learner age. This might reflect the greater gaps in development which exist between higher-numbered boxes on the Routemap in comparison to those between the lower-numbered boxes. It is also in part due to different learners being present within the different years and learners leaving the dataset when they progressed beyond RfL. This explains why mean performance of year groups is lower with increasing age, although progress is still evident. The same explanation is given by Ndaji and Tymms for the drop in average performance after year 10 of pupils with Moderate Learning Disabilities on the P Scales (Ndaji and Tymms 2009, 158).

It is also the case that the nature of the curriculum changes as learners move through the year groups, with a growing emphasis on daily living skills and the broader experiences associated with adult life in the community. From Key Stage 4 onwards, there is a mandatory requirement in Wales to provide an externally accredited curriculum. This may mean that more emphasis was given to evidencing coverage of required content and correspondingly less to the developmental steps represented on the Routemap.

Regression is only evident in four out of 252 learner-years. There do not appear to be data on the prevalence of progressive neurological conditions in learners with PMLD, but Male and Rayner (2009) found that 10% of learners in special schools experienced life-limiting conditions. Some of these learners are likely to show regression in some learner years. Hence, the finding that some learners regress is not unexpected. The ability of RfL to identify regression can act as a prompt for further investigation.

Limitations

The challenges of research in this field are well documented in Maes et al. (2021). In the current study, data was collected by a single school in which staff members collaborated closely. Thus, the order in which boxes were achieved may in part be determined by the teaching strategy of the school. In addition, the school had been closely involved with the development of the materials. This meant they were well understood, but also that the staff believed in the integrity of the assessment.

The data was very 'messy' as learners entered and left the dataset throughout the data collection period, and even within a Key Stage relatively few learners were present throughout. However, this is an important dataset, as there is currently very little data on the progress of learners with PMLD and the data was collected over 13 years and across all Key Stages.

Generalisability of findings is limited by several factors. This is a relatively small dataset containing 54 learners, where only two learners have data for all data points. Analysis was retrospective, meaning that no further details were available. For example, additional data on the learners or assessors was unavailable.

Learners in the dataset were all from one setting; however, this also has advantages. Teachers submitted their assessment data which was moderated using a team approach; thus increasing the likelihood that criteria were applied consistently across the dataset and removing variation that might have occurred using unmoderated data or data collected from different settings.

Implications

This research highlights a major challenge in attempting to measure the progress of learners with PMLD; longitudinal data is needed in order for progress to be measured, but high-quality longitudinal data is very difficult to collect for sizeable groups of these learners. The lack of an available system for electronic data collection has been identified by practitioners as a significant limitation of RfL. In this research, the availability of a significant and coherent dataset, which was gathered electronically, greatly facilitated analysis and demonstrates that there would be a further benefit in addressing the deficiency identified by teachers (McDermott and Atkinson 2016; Van Walwyk 2011; Weston and Ware 2018). (Endnote- This issue has recently been addressed by some commercial providers). If datasets were available from different settings, the findings provide tentative evidence that RfL could be used to compare the progress of learners with PMLD receiving different forms of provision.

The study also provides evidence of the uneven progress of learners with PMLD, the likelihood that different learners will achieve skills in different orders and the possibility that progress for these learners might slow, or appear to slow, as they grow older, at least in those areas assessed by RfL. This provides important reassurance for teachers.

This study validates the non-linear model of progress adopted by RfL, as appropriate for this group of learners, and supports the concept of lateral progress (Hogg 2017; Rendoth, Duncan, and Foggett 2021; Welsh Assembly Government

2006). Despite limitations, the research shows that the great majority of learners with PMLD did make progress over time. This research also shows that RfL is a useful tool for demonstrating this progress and for identifying plateauing and regression, thus enabling appropriate educational opportunities to be provided. This study shows that people with PMLD benefit from the education which is their right.

Acknowledgments

The authors gratefully acknowledge the support of [blinded for review], in allowing access to an anonymised version of the data held on learner progress as measured by Routes for Learning.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethical statement

The research received ethical approval from [blinded for review] University; EthOS reference number 15995.

References

Aidonopoulou-Read, T. 2021. "Can the Engagement Model Act as a Replacement for the P-Scale Assessment System?" *Support for Learning* 36 (2): 258–277. https://doi.org/10.1111/1467-9604.12354.

Aksamit, D., and J. J. Wheeler. 2021. "Children and Adults with Profound Intellectual Disabilities in Poland: Legal Issues and Educational Services." *International Journal of Special Education (IJSE)* 35 (2): 5–18. https://doi.org/10.52291/ijse.2020.35.9.

Carpenter, B., J. Carpenter, J. Egerton, and B. Cockbill. 2016. "The Engagement for Learning Framework: Connecting with Learning and Evidencing Progress for Children with Autism Spectrum Conditions." *Advances in Autism* 2 (1): 12–23. https://doi.org/10.1108/AIA-10-2015-0021.

Department for Education and Employment and Qualifications and Curriculum Agency. 2001. *Supporting the Target Setting Process (Revised March 2001): Guidance for Effective Target Setting for Pupils with Special Educational Needs*. London: Department for Education and Employment.

Dhondt, A., I. Van Keer, A. van der Putten, and B. Maes. 2020. "Communicative Abilities in Young Children with a Significant Cognitive and Motor Developmental Delay." *Journal of Applied Research in Intellectual Disabilities* 33 (3): 529–541. https://doi.org/10.1111/jar.12695.

Donnelly, V. 2005. "Developing an Effective Assessment for Learners with PMLD." Paper presented at the Inclusive and Supportive Education Congress International Special Education Conference – Inclusion, Glasgow, Scotland, Celebrating Diversity.

Fergusson, A., and B. Richard. 2015. "Recognising Progress: Assessing Outcomes for Learners with SLD/PMLD." In *The Routledge Companion to Severe, Profound and Multiple Learning Difficulties*, edited by P. Lacey, R. Ashdown, P. Jones, H. Lawson, and M. Pipe, 246–257. London: Routledge. https://doi.org/10.4324/9781315717913.

Grunewald, K. 2009. *Från idiot till medborgare [From idiot to citizen]*. Stockholm: Gothia Förlag.

Harlen, W., and M. James. 1997. "Assessment and Learning: Differences and Relationships Between Formative and Summative Assessment." *Assessment in Education Principles, Policy & Practice* 4 (3): 365–379. https://doi.org/10.1080/0969594970040304.

Hinchcliffe, V. 2022. "Developing Thinking Teachers: Reflective Practice in Schools for Children with Severe Learning Disabilities and Profound and Multiple Learning Disabilities." *Support for Learning* 37 (4): 502–519. https://doi.org/10.1111/1467-9604.12424.

Hogg, R. 2017. "Assessing Progress for Learners with PMLD (part 1)." *The SLD Experience* 77 (1): 8–15.

Iacono, T., D. West, K. Bloomberg, and H. Johnson. 2009. "Reliability and Validity of the Revised Triple C: Checklist of Communicative Competencies for Adults with Severe and Multiple Disabilities." *Journal of Intellectual Disability Research* 53 (1): 44–53. https://doi.org/10.1111/j.1365-2788.2008.01121.x.

Imray, P., L. Kossyvaki, and M. Sissons. 2023. "Evidence-Based Practice: The Use and Abuse of Research." *Support for Learning* 38 (1): 51–66. https://doi.org/10.1111/1467-9604.12438.

Kerr, A. M., D. McCulloch, K. Oliver, B. McLean, E. Coleman, T. Law, P. Beaton, et al. 2003. "Medical Needs of People with Intellectual Disability Require Regular Reassessment, and the Provision of Client- and Carer-Held Reports." *Journal of Intellectual Disability Research* 47 (2): 134–145. https://doi.org/10.1046/j.1365-2788.2003.00453.x.

Kontu, E., and R. Pirttimaa. 2008. "The Assessment of Severely Intellectually Disabled Students." *European Journal of Special Needs Education* 23 (1): 75–80. https://doi.org/10.1080/08856250701791427.

Lacey, P., and S. Jeanette. 2015. "Inclusive Education for Learners with Severe, Profound and Multiple Learning Difficulties in England." In *Including Learners with low-Incidence Disabilities (International Perspectives on Inclusive Education*, edited by E. West, 241–268. Vol. 5. Bingley, UK: Emerald Group. https://doi.org/10.1108/S1479-363620140000005026.

Lyons, G., and M. Arthur-Kelly. 2014. "UNESCO Inclusion Policy and the Education of School Students with Profound Intellectual and Multiple Disabilities: Where to Now?" *Creative Education* 5 (7): 445–456. https://doi.org/10.4236/ce.2014.57054.

Maes, B., S. Nijs, S. Vandesande, I. Van Keer, M. Arthur-Kelly, J. Dind, J. Goldbart, et al. 2021. "Looking Back, Looking Forward: Methodological Challenges and Future Directions in Research on Persons with Profound Intellectual and Multiple Disabilities." *Journal of Applied Research in Intellectual Disabilities* 34 (1): 250–262. https://doi.org/10.1111/jar.12803.

Male, D. B., and M. Rayner. 2009. "Who Goes to SLD Schools in England? A Follow-Up Study." *Educational and Child Psychology* 26 (4): 19–30. https://doi.org/10.53841/bpsecp.2009.26.4.19.

McDermott, H., and C. Atkinson. 2016. "Routes for Learning: Professionals' Implementation of the Approach in Supporting Children with Profound and Multiple Learning Difficulties." *The SLD Experience* 75 (1): 10–17.

McGuire, B. E., P. Daly, and F. Smyth. 2010. "Chronic Pain in People with an Intellectual Disability: Under-Recognised and Under-Treated?" *Journal of Intellectual Disability Research* 54 (3): 240–245. https://doi.org/10.1111/j.1365-2788.2010.01254.x.

McKenzie, J. 2021. "Intellectual Disability in Inclusive Education in South Africa: Curriculum Challenges." *Journal of Policy and Practice in Intellectual Disabilities* 18 (1): 53–57. https://doi.org/10.1111/jppi.12337.

Ndaji, F., and P. Tymms. 2009. *The P Scales: Assessing the Progress of Children with Special Educational Needs*. Chichester: Wiley-Blackwell. https://doi.org/10.1002/9780470682227.

Ndaji, F., and P. Tymms. 2010. "The P Scales: How Well are They Working?" *British Journal of Special Education* 37 (4): 198–208. https://doi.org/10.1111/j.1467-8578.2010.00481.x.

Poujol, A.-L., A. Boissel, D. Guédon, N. Guénolé, D. Mellier, and R. Scelles. 2021. "Évaluation-Cognition -Polyhandicap (ECP) : Apports d'Une Approche Qualitative Dans l'Élaboration et La Validation d'Un Outil." *Psychologie Française* 66 (3): 207–222. https://doi.org/10.1016/j.psfr.2020.09.003.

Rendoth, T., J. Duncan, and J. Foggett. 2021. "Inclusive Curricula for Students with Severe Intellectual Disabilities or Profound and Multiple Learning Difficulties: A Scoping Review." *Journal of Research in Special Educational Needs* 22 (1): 76–88. https://doi.org/10.1111/1471-3802.12544.

Rochford, D. 2016. *The Rochford Review: Final Report. Review of Assessment for Pupils Working Below the Standard of National Curriculum Tests: Standards and Testing Agency*. https://assets.publishing.service.gov.uk/media/5a80b4c2e5274a2e8ab51b35/Rochford_Review_Report_v5_PFDA.pdf.

Scelles, R. 2017. “Evaluation– Cognition– Polyhandicap (ECP).” https://www.reseau-lucioles.org/wp-content/uploads/2019/06/Rapport-final-ECP.pdf.

Schopler, E., E. Mary, V. Bourgondien, G. J. Wellman, and R. L. Steven. 2010. *The Childhood Autism Rating Scale, CARS2*. 2nd ed. Los Angeles, CA: Western Psychological Services.

Smith, E., V. Critten, and R. Vardill. 2020. “Assessing Progress in Children with severe/Profound Intellectual Disabilities: What are the Issues?” *Disability & Society* 35 (10): 1688–1692. https://doi.org/10.1080/09687599.2020.1719042.

Standards and Testing Agency. 2020. *The Engagement Model: Guidance for Maintained Schools, Academies (including Free Schools) and Local Authorities*. London: Department for Education Publications. https://assets.publishing.service.gov.uk/media/5f19be233a6f40727dc2e452/Engagement_Model_Guidance_2020.pdf.

UN General Assembly. 1989. “Convention on the Rights of the Child.” https://www.refworld.org/legal/agreements/unga/1989/en/18815 .

UN General Assembly. 2006. “Convention on the Rights of Persons with Disabilities.” https://www.refworld.org/legal/resolution/unga/2007/en/49751.

van Splunder, J., J. S. Stilma, R. M. D. Bernsen, and H. M. Evenhuis. 2006. “Prevalence of Visual Impairment in Adults with Intellectual Disabilities in the Netherlands: Cross-Sectional Study.” *The Eye* 20 (9): 1004–1010. https://doi.org/10.1038/sj.eye.6702059.

van Timmeren, E. A., C. P. van der Schans, A. A. J. van der Putten, W. P. Krijnen, H. A. Steenbergen, H. M. J. van Schrojenstein Lantman-de Valk, and A. Waninge. 2017. “Physical Health Issues in Adults with Severe or Profound Intellectual and Motor Disabilities: A Systematic Review of cross-Sectional Studies.” *Journal of Intellectual Disability Research* 61 (1): 30–49. https://doi.org/10.1111/jir.12296.

Van Walwyk, L. 2011. “Measuring Progress in Children with Profound and Multiple Learning Difficulties.” *The SLD Experience* 60 (1): 9–16.

Vlaskamp, C., B. F. van der Meulen, and M. Smrkovsky. 1999. *GedragsTaxatie-Instrument GTI: Voor personen met ernstige meervoudige beperkingen [Behavior Appraisal Scales, Manual]*. Groningen NL: Stichting Kinderstudies.

Welsh Assembly Government. 2006. *Routes for Learning - Assessment Materials for Learners with Profound Learning Difficulties and Additional Disabilities*. Cardiff: Welsh Assembly Government.

Welsh Government. 2020a. “Routes for Learning.” https://hwb.gov.wales/curriculum-for-wales/routes-for-learning.

Welsh Government. 2020b. “Routes for Learning: Routemap Explanatory Note.” https://hwb.gov.wales/curriculum-for-wales/routes-for-learningWessels .

Wessels, M. D., A. A. J. Putten, and M. C. S. Paap. 2021. “Inventory of Assessment Practices in People with Profound Intellectual and Multiple Disabilities in Three European Countries.” *Journal of Applied Research in Intellectual Disabilities* 34 (6): 1521–1537. https://doi.org/10.1111/jar.12896.

Weston, H., and J. Ware. 2018. “The Use of the ‘Routes for Learning’ Assessment for Learners with Profound and Multiple Learning Difficulties (PMLD) in England and Wales.” *The SLD Experience* 79 (1): 15–23.