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Cognitive and Psychological Approaches in New Generation English Language Materials: Information Perception Characteristics of Blind Learners

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Abstract: The article determines which properties of English coursebook tasks remain inaccessible to a blind learner. The braille edition of the Light Up 7 package is analysed and a set of checks for authors of teaching materials is proposed.

Keywords: Braille, coursebook design, English language teaching, inclusive education, tactile perception, Uzbekistan, visual impairment.

1. Introduction

A blind pupil in an Uzbek special school studies English from the same national curriculum as any other pupil. The coursebook reaches that pupil after being converted into braille by the national printing house. Conversion of this kind preserves the language content, and it does not examine why the exercises were written as they were, since the decision to convert is taken only after the book has been designed.

The consequence is that adaptation is handled as a production question rather than a methodological one. An edition is judged by whether it is legible, and not by whether its tasks can be completed. Research from several countries describes the same situation. Zahra, Butt and Bhatti [1] investigated the difficulties teachers of English face with blind pupils and reported a shortage of usable basic materials. Asri, Suryati and Setyowati [2] identify inadequate braille sources as one of the main impediments in Indonesian special schools, alongside uneven pupil competence and reduced contact hours. Zounhin Toboula, Hounnou and Videkon [3] reach a comparable conclusion in Benin, working with 57 visually impaired and 143 sighted pupils in the same classrooms. Cárdenas and Inga [4] review the field and propose a methodological framework for inclusive English teaching, and Miyauchi [5], synthesising eighteen peer-reviewed studies of inclusive education for pupils with visual impairment, reports that teachers' sense of being unprepared is among the factors most strongly associated with outcomes. What these studies have in common is that the teacher and the learner are the object of analysis. The coursebook itself is seldom examined. Research on how blind learners take in information has been available for several decades and bears directly on this omission. Four findings are particularly relevant.

The first concerns reading speed. Legge, Madison and Mansfield [6] measured braille reading in experienced adult readers with procedures closely matched to a standard print

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test and found a median of 124 words per minute against a print median of 251. Millar [7] attributes the difference to the serial character of touch, since the reader recovers approximately one character at a time. What this affects is time and the amount of material that can be covered, while understanding of what has been read is affected considerably less. The variable to adjust is therefore quantity and pacing, and simplifying the language would answer a difficulty that the evidence does not describe.

The second concerns pictures. Vinter, Orlandi and Morgan [8] reviewed sixteen studies of tactile picture naming and reported identification rates between 9 and 85 per cent, with an average of 42 per cent. Raised line drawings account for most of the low results, while textured images perform better. Hatwell, Streri and Gentaz [9] describe the underlying constraint, namely that haptic exploration proceeds through a limited set of exploratory procedures and delivers information sequentially, so a two-dimensional outline must be assembled from partial impressions. A picture converted into a raised line drawing therefore has less than an even chance of being recognised, which means that conversion of this kind moves the difficulty rather than removing it.

The third concerns how much can be held in mind at one time. Cornoldi and Vecchi [10] and Cattaneo and Vecchi [11] conclude that blind learners build and use spatial representations without difficulty, while differences in performance appear in tasks requiring several elements to be held and compared simultaneously. Cattaneo and colleagues [12] reach a comparable conclusion, observing that difficulty rises with the complexity of the representation rather than with the spatial nature of the material. Mayer [13] offers the nearest framework from instructional design, although the modality principle assumes two functioning channels and does not transfer directly. Where one channel is unavailable, the segmenting and pre-training principles carry the weight the modality principle would carry elsewhere.

The fourth concerns visual vocabulary. Landau and Gleitman [14] followed a congenitally blind child and found that she used verbs such as *look* and *see* appropriately, taking their meaning from the sentences in which they occurred. Words of this kind need not be removed from a syllabus provided they are taught through context. The finding does not support explaining such words in terms of visual perception, since an explanation of that sort assumes exactly the experience the learner lacks.

These findings rest on a position stated much earlier by Vygotsky [15], for whom the consequences of a sensory defect are determined by the social and instructional conditions surrounding the child, with development proceeding along an indirect route in which intact functions take over. Recent neurocognitive work has given the position a more specific basis. Bedny [16] reviews evidence that occipital regions in congenitally blind adults participate in language processing, and Röder and Rösler [17] report an advantage in long-term memory for environmental sounds. Cattaneo and Vecchi [11] caution that such advantages are uneven across tasks and are concentrated in those who lost sight early, which means that a coursebook cannot be designed for a single learner profile. Work located specifically in foreign language education remains limited. Jedynak [18] relates cognitive, motor and socio-emotional development to attainment in a foreign language, and Krisi, Nagar and Knoll [19] identify self-perceptions of competence, achievement motivation and locus of control among blind students learning English. Studies of assistive technology [20] and reviews of inclusive practice [5] address the delivery of material rather than its design.

The research problem is that no set of checks exists by which the author of an English coursebook can establish, before printing, which of the tasks in it will be inaccessible to a blind learner. Adaptation is consequently evaluated after the fact and by the wrong criterion.

The object of the research is the process of designing English language teaching materials for learners with visual impairment.

The subject of the research is the visual dependency of tasks in an English coursebook prepared directly in braille.

The aim of the research is to determine, on the basis of research into tactile and auditory perception, which properties of coursebook tasks remain inaccessible to blind learners, and to formulate a corresponding set of checks for coursebook authors.

Research tasks:

- to analyse research on how blind learners take in information through touch and hearing;
- to formulate what each of these findings requires of the author of a coursebook;
- to examine a coursebook written directly in braille against those requirements;
- to establish how the residual difficulties are distributed across the units of the course;
- to propose replacements that preserve the language content.

The hypothesis is that a coursebook written directly in braille removes those barriers that are apparent on inspection of a page and retains those that are not.

2. Materials and methods of research

The theoretical basis of the study was formed by research on braille reading speed [6, 7], on haptic perception and the recognition of tactile images [8, 9], on spatial representation and the limits of simultaneous processing in blindness [10, 11, 12], and on the acquisition of visually grounded vocabulary [14]. Work in foreign language education with blind learners [1, 2, 3, 4, 18, 19] was used to establish what has already been examined and what has not.

The empirical basis was the complete *Light Up 7* package [21], braille first edition, published in Tashkent in 2018 by the printing house for the blind of the Republic of Uzbekistan under applied project OT-A1-63 and approved for publication by the academic council of Uzbekistan State World Languages University. The course covers ten thematic units of five lessons each and is intended for Grade 7 pupils of special general-education schools. The Pupil's Book contains 216 exercises and the Workbook 75, giving 291 pupil-facing exercises in total. The Teacher's Book, containing 312 instruction blocks, was consulted as corroborating evidence on the wording of instructions and was not counted.

The procedure was as follows. Four requirements were derived from the theoretical sources and stated in advance, as set out in Table 1. Every exercise in the two pupil-facing volumes was then read against those requirements, and the outcome was recorded together with the unit in which the exercise appears. Occurrences of the words *picture* and *colour* inside reading passages and vocabulary glosses were recorded separately and not counted as task requirements, since they impose no procedural demand. Counts were then expressed as a proportion of the exercises in each unit.

Each requirement was coded on a stated surface criterion, so that the reading could be repeated. An exercise was recorded as picture-dependent if its instruction or any of its items required the learner to consult a picture in order to answer. It was recorded as spatially organised if completing it required two or more sets of elements to be held and compared at the same time, which covers matching pairs, two-column tasks, comparison grids, survey tables and gap-fills supplied with a word box. It was recorded as assuming a mark on the page if the instruction used circle, tick, underline or cross out. It was recorded as resting on colour if a colour term carried the answer rather than appearing incidentally in a passage. An exercise meeting more than one criterion was counted under each, which is why the categories in Table 2 do not sum to the final row.

The present author is one of the four compilers of the coursebook examined. The analysis is therefore a developer's review of shared work rather than an independent

evaluation, and the requirements in Table 1 were fixed from the published literature before the material was read, so that they would not be shaped by it.

Table 1. Requirements for a coursebook arising from the perception evidence.

Finding	What it constrains	What the author should do
Braille reading is about half as fast as print [12, 14]	Time and quantity, not level of difficulty	Reduce text per page and items per task; keep the language level
Raised line pictures are identified in fewer than half of cases [8, 18]	Any task whose answer lies in a picture	Replace with description, a real object, or a textured image
Holding several elements at once is the limiting factor [5, 6, 7]	Matching columns, tables, comparison grids	Present the same content as a numbered sequence
Visually grounded words are learned from context [11]	How such words are explained, not whether they appear	Teach through use; avoid definitions based on seeing

3. Results and discussion

On the second requirement in Table 1 the edition performs well. Across the 291 numbered exercises there is no task that requires the learner to consult a picture in order to answer it. Picture references survive only in the revision and project sections, which lie outside the numbered exercise count: six instructions there ask pupils to illustrate their ideas or their plan with pictures, photographs and drawings, or to make a collage. All six are production tasks rather than comprehension ones, and none of them carries an answer. This is a substantive difference from a converted edition and represents considerable work by the authoring team.

Three other difficulties survived. Their distribution is given in Table 2.

Table 2. Surviving difficulties in the two pupil-facing volumes.

Difficulty	Pupil's Book (n=216)	%	Workbook (n=75)	%	Total %
Picture dependency	0	0.0	0	0.0	0.0
Spatial organisation of the task	25	11.6	14	18.7	13.4
Instruction assuming a mark on the page	21	9.7	8	10.7	10.0
Content resting on colour	4	1.9	2	2.7	2.1
At least one of the above	47	21.8	23	30.7	24.1

The most frequent difficulty is the spatial organisation of the task. The Workbook opens Unit 5 with nine sentence beginnings and nine endings to be joined; Unit 8 matches twelve countries with twelve nationalities; Unit 6 matches five terms with five definitions arranged, as the instruction still states, in the right-hand column; and Unit 10 asks pupils to complete a survey grid of six rows and three columns, each row holding three lettered options. In print the learner scans both sides and proceeds by elimination. In braille the two sides are read one after the other and the candidates must be held in memory, which is precisely the condition identified as limiting in the third finding [10, 11]. Taken with the reading speed evidence [6], a task of this kind consumes time twice over, once for the slower reading and once for the reconstruction.

The second difficulty is the verb used in the instruction. Pupils are asked to circle a choice, to tick a sentence after listening, to underline gerunds in a set of eight sentences, to underline present passive forms in a nine-sentence text, and to cross out the odd word in eight sets. Underlining in a print exercise records an intermediate decision so that it can be reviewed at the end, which is why it appears in tasks asking the learner to identify several items in a passage. A braille reader cannot mark the page, so those decisions must be held in memory or written out separately. The Teacher's Book passes the assumption on rather

than correcting it, at one point directing the teacher to have pupils write the sentences in their notebooks and underline the target form.

The third difficulty concerns colour and appears almost entirely within one unit. The unit on national identity asks pupils in the Pupil's Book to supply four missing colours of the flag, and three of the ten quiz questions in the Workbook ask which colour stands for the sky and water, for peace and good fortune, and for nature and new life. These items are answerable from taught verbal knowledge and the fourth finding [14] supports keeping them in the syllabus. The same unit, however, glosses the word colour as a sensation produced on the eye by rays of light when resolved as by a prism into different wavelengths. That definition is carried over from a general dictionary and cannot function for the intended reader. The contrast within a single unit between a defensible treatment and an indefensible one suggests that the two decisions were not taken with equal attention.

The three difficulties are not spread evenly through the course. Figure 1 gives the distribution by unit.

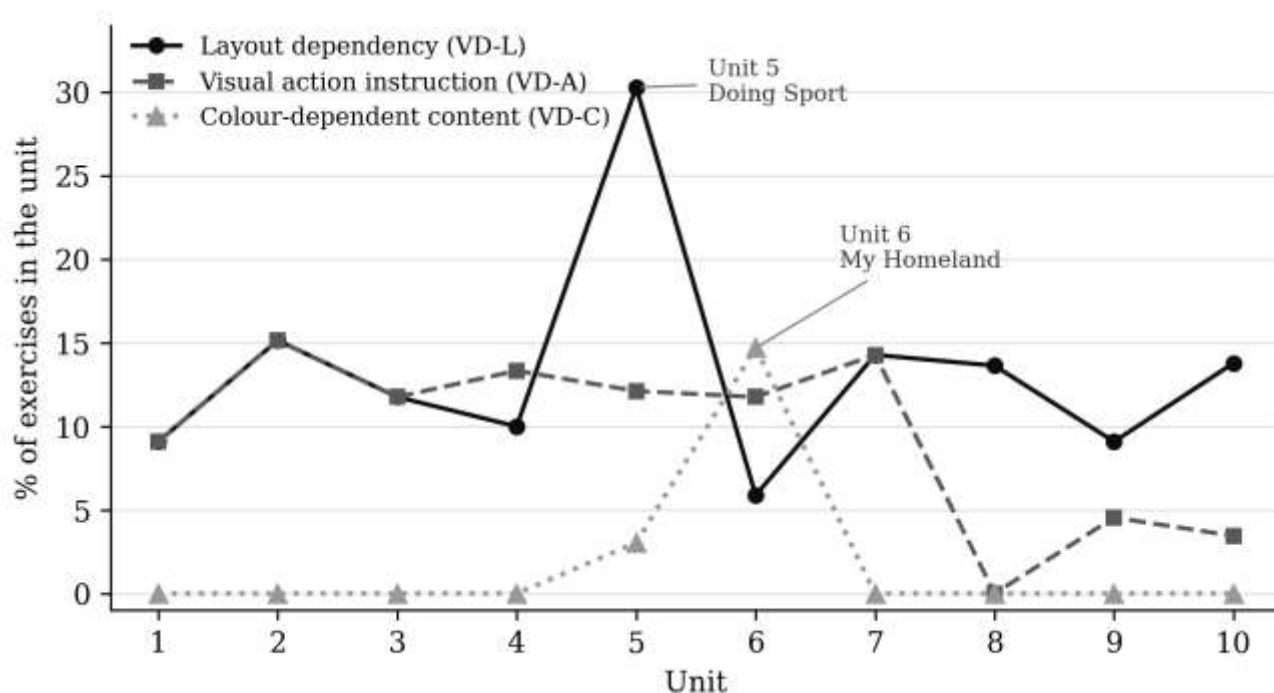


Figure 1. Surviving difficulties by unit, as a percentage of the exercises in that unit (291 exercises).

Spatial organisation reaches 30.3 per cent in Unit 5, where the Workbook opens with a nine-item joining task and closes with a card game played in groups, and falls to 5.9 per cent in the unit that follows. Colour-dependent content is almost absent from the course as a whole and concentrates in Unit 6, reaching 14.7 per cent because that unit deals with the flag and the emblem. Instructions assuming a mark on the page behave differently, holding between 9 and 15 per cent through the first seven units before dropping to zero in Unit 8.

This uneven distribution has a practical consequence. A load spread evenly through a book would require every unit to be revised. A load that clusters can be addressed where it clusters, which matters when a national edition is reprinted on a fixed budget. In the present case three units account for a disproportionate share.

The pattern as a whole is consistent with the hypothesis. The team removed the difficulty it could see, which was the picture, and kept three that are less visible. A two-column matching exercise looks like ordinary text, an instruction to underline reads as an

everyday classroom verb, and a question about the colours of the flag looks like a question about national symbols. The difficulties that survived are those that do not announce themselves on the page, which suggests that what a development team lacks is not commitment so much as a stated list of features to check.

4. Conclusions

Based on the research conducted, writing a coursebook directly in braille removes picture dependency from the exercise material, ensuring that no numbered exercise requires access to an image except in optional project sections involving production tasks. However, three main difficulties persist after this process—namely spatial task organization, instructions assuming marks can be made on the page, and content reliant on color—which together affect roughly one in four exercises. Fortunately, these difficulties are unevenly distributed, allowing revision to be targeted at specific high-load units rather than requiring a overhaul of the entire book. Furthermore, each issue has a straightforward replacement that leaves the core language content untouched: paired columns can be rewritten so each item carries its own options, tables can become a sequence of short questions, instructions to underline can be changed to writing out or speaking aloud, and visually explained words can be defined by their use. Ultimately, applying these four requirements before a national edition goes to press provides a significantly less costly point of intervention than attempting corrections after printing.

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