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Project Title: Rwanda Primary School Pupils' Cognitive Flexibility and Learning Outcomes

This dataset records responses from 306 public primary school children during data collection in Rwanda in 2018. Specifically, each pupil completed two assessments to measure their cognitive flexibility (the Dimension Change Card Sort (DCCS) and Flexible Item Selection Task (FIST)), one measure of their non-verbal reasoning (the Object Pattern-Based Reasoning Assessment (OPRA)) and one measure of their wider executive function and problem-solving skills (the Tower of Hanoi (TOH)). The participants also completed up to four tasks to ascertain their basic reading skills and answered questions from a survey examining different family and background characteristics. All children were assessed and surveyed one-to-one in their mother tongue, Kinyarwanda. Data are only provided for pupils who consented to take part in the research.

The DCCS involved pupils matching cards against two target cards, showing images of a Green Goat and a Yellow Motorcycle. In the first round, pupils were asked to sort by colour, before being instructed to sort the cards by shape. Only pupils who achieved minimum performance thresholds proceeded to the more advanced rounds. In the third round, some of the card images were shown in black 'boxes'. The pupils were instructed that cards with boxes should be sorted by image colour, and those without by image shape. All pupils who completed the third 'box' round also undertook a fourth 'box' round under timed conditions where they were instructed to sort the cards as quickly as possible. Performance was timed using both timer functions in the data collection software and separate stopwatches.

The OPRA assessed children's non-verbal reasoning by asking them to complete short sequences of six familiar objects (for example, pebbles, toothpicks and beans). In each case, an item is missing from the pattern and the pupils are invited to pick one object to complete the sequence.

The FIST presented pupils with a series of boxes featuring numerous different images (cups, chickens and shoes). Participants were invited to point at two boxes that matched on one dimension (for example, colour, shape, size or number) and then two boxes that matched on another dimension. In each case, they were asked to explain the reason for their match. All pupils completed two basic criterial trials and a demonstration trial, and had to achieve a minimum standard to undertake the main trials, which comprised three boxes that could be matched on two dimensions, and four boxes that could be matched on four dimensions. Pupils had to achieve a minimum score on the two-match trials to progress to the four-match trials.

The TOH was used to measure children's general executive function and problem solving by assessing their ability to complete progressively challenging trials to stack up to four disks at the end of three pegs. The rules were that: (i) disks had to remain on the pegs unless being moved; (ii) only one disk could be moved at a time; and (iii) larger disks could not go on smaller disks. The trials started with scenarios using three disks that could be solved using two moves, progressing to three-disk problems that could be solved with seven moves. Pupils needed to complete two consecutive trials successfully to proceed to the next trial. Top performers also

undertook a trial using four disks. The last two trials were timed, again using both tablet timer functions and separate stopwatches, and participants instructed to solve the problem as quickly as possible.

Finally, the pupils completed up to four basic literacy tasks. These comprised: (i) sounding up to 100 letters in 60 seconds; (ii) reading up to 50 familiar words in 60 seconds; (iii) reading a short passage (27 words) and answering five comprehension questions; and (iv) reading a longer passage (59 words) and answering five comprehension questions. Children needed to achieve minimum thresholds on the earlier tasks to progress to the more advanced reading tasks.

The variables in the dataset are described in detail in the table below. Unless otherwise specified, for dichotomous variables 0 represents 'no' or an incorrect/negative response, while 1 represents 'yes' or a correct/positive response. (For full details of response options used, see file 'Rwanda_Cognitive_Flexibility_Study_-_Schedule_of_Response_Options.')

Variable Name	Variable Type/ Scale	Description
today	String	Date of data collection with the individual pupil
enumerator	Discrete/ Nominal	Which of four enumerators assessed the individual pupil
school	Discrete/ Nominal	Which of four schools the pupil attended
district	Discrete/ Dichotomous	Which of two districts the pupil's school was located in
co_enumeration	Discrete/ Dichotomous	Whether or not the pupil's assessment was co-enumerated and observed by the principal researcher
class	Discrete/ Dichotomous	Whether the pupil was in Primary 1 or Primary 4
pupil_code	String	Unique alphanumeric code for each pupil
female	Discrete/ Dichotomous	Whether the pupil was a girl or a boy
school_age	Discrete/ Ratio	Pupil age as recorded in the school register
pupil_age	Discrete/ Ratio	Pupil age as reported by the pupil him/herself
dob_know	Discrete/ Dichotomous	Whether the pupil reported knowing his/her exact date of birth
dccs_prst_[3-8]	Discrete/ Dichotomous	Pupil response to DCCS pre-switch trial [3-8] where 1 indicates selection of the Green Goat, 2 indicates selection of the Yellow Motorcycle and 3 indicates no response
dccs_prst_[3-8]s	Discrete/ Dichotomous	Pupil score on DCCS pre-switch trial [3-8] where pupils receive 1 point for correctly matching the card and 0 otherwise

dccs_prst_score	Discrete/ Ratio	Pupil total score out of 6 on DCCS pre-switch trials
dccs_post_[10-15]	Discrete/ Dichotomous	Pupil response to DCCS post-switch trial [10-15] where 1 indicates selection of the Green Goat, 2 indicates selection of the Yellow Motorcycle and 3 indicates no response
dccs_post_[10-15]s	Discrete/ Dichotomous	Pupil score on DCCS post-switch trial [10-15] where pupils receive 1 point for correctly matching the card and 0 otherwise
dccs_post_score	Discrete/ Ratio	Pupil total score out of 6 on DCCS post-switch trials
dccs_bt_[19-30]	Discrete/ Dichotomous	Pupil response to DCCS box trial [19-30] where 1 indicates selection of the Green Goat, 2 indicates selection of the Yellow Motorcycle and 3 indicates no response
dccs_bt_[19-30]s	Discrete/ Dichotomous	Pupil score on DCCS box trial [19-30] where pupils receive 1 point for correctly matching the card and 0 otherwise
dccs_bt_score	Discrete/ Ratio	Pupil total score out of 12 on DCCS box trials
dccs_tbt_start	Discrete/ Ratio	Time in seconds at which pupil started the timed box trials calculated from the time at which the enumerator started completing the assessment form
dccs_tbt_[33-44]	Discrete/ Dichotomous	Pupil response to DCCS timed box trial [33-44] where 1 indicates selection of the Green Goat, 2 indicates selection of the Yellow Motorcycle and 3 indicates no response
dccs_tbt_[33-44]s	Discrete/ Dichotomous	Pupil score on DCCS timed box trial [33-44] where pupils receive 1 point for correctly matching the card and 0 otherwise
dccs_tbt_end	Discrete/ Ratio	Time in seconds at which pupil ended the timed box trials calculated from the time at which the enumerator started completing the assessment form
dccs_tbt_time_m	Discrete/ Ratio	Time in minutes for pupil to complete the timed box trials, taken from the stopwatch
dccs_tbt_time_s	Discrete/ Ratio	Time in seconds for pupil to complete the timed box trials, taken from the stopwatch
dccs_tbt_time_auto	Discrete/ Ratio	Time in seconds for pupil to complete the timed box trials, calculated as the difference between the recorded start and stop times
dccs_tbt_score	Discrete/ Ratio	Pupil total score out of 12 on DCCS timed box trials
opra_[a-j]	Discrete/ Nominal	Pupil selection of small familiar item to complete OPRA trial [a-j] (selection options vary across rounds of the OPRA)

opra_[a-j]s	Discrete/ Dichotomous	Pupil total score on OPRA trial [a-j] where pupils receive 1 point for selecting the correct item and 0 otherwise
opra_score	Discrete/ Ratio	Pupil total score out of 10 on OPRA task
fist_crit[1-2]	Discrete/ Nominal	Pupil response on criterial trial [1-2] to match two identical image boxes
fist_crit[1-2]s	Discrete/ Dichotomous	Pupil score on criterial trial [1-2] where pupils receive 1 point for matching the identical image boxes and 0 otherwise
fist_2m_d	Discrete/ Nominal	Pupil response on demonstration trial to match two similar image boxes
fist_2m_ds	Discrete/ Dichotomous	Pupil score on demonstration trial where pupils receive 1 point for matching the similar boxes and 0 otherwise
fist_crits	Discrete/ Ratio	Pupil total score out of 3 on the FIST criterial and demonstration trials, which determined progress to the subsequent rounds
fist_2m_[1-6]am	Discrete/ Nominal	Pupil's first response to match two boxes on FIST 2-match trial [1-6]
fist_2m_[1-6]ar	Discrete/ Nominal	Pupil's given reason for his/her first match on FIST 2-match trial [1-6] (options being colour, shape, number or size)
fist_2m_[1-6]as	Discrete/ Dichotomous	Pupil score on his/her first match on FIST 2-match trial [1-6] where pupils receive 1 point where both match and reason given are correct and 0 otherwise
fist_2m_[1-6]bm	Discrete/ Nominal	Pupil's second response to match two boxes on FIST 2-match trial [1-6]
fist_2m_[1-6]br	Discrete/ Nominal	Pupil's given reason for his/her second match on FIST 2-match trial [1-6] (options being colour, shape, number or size)
fist_2m_[1-6]bs	Discrete/ Dichotomous	Pupil score on his/her second match on FIST 2-match trial [1-6] where pupils receive 1 point where both match and reason given are correct and 0 otherwise
fist_2m_[1-6]s	Discrete/ Ratio	Pupil total score out of 2 on FIST 2-match trial [1-6]
fist_2m_s	Discrete/ Ratio	Pupil total score out of 12 on FIST 2-match trials
fist_4m_[1-6]am	Discrete/ Nominal	Pupil's first response to match two boxes on FIST 4-match trial [1-6]
fist_4m_[1-6]ar	Discrete/ Nominal	Pupil's given reason for his/her first match on FIST 4-match trial [1-6] (options being colour, shape, number or size)

fist_4m_[1-6]as	Discrete/ Dichotomous	Pupil score on his/her first match on FIST 4-match trial [1-6] where pupils receive 1 point where both match and reason given are correct and 0 otherwise
fist_4m_[1-6]bm	Discrete/ Nominal	Pupil's second response to match two boxes on FIST 4-match trial [1-6]
fist_4m_[1-6]br	Discrete/ Nominal	Pupil's given reason for his/her second match on FIST 4-match trial [1-6] (options being colour, shape, number or size)
fist_4m_[1-6]bs	Discrete/ Dichotomous	Pupil score on his/her second match on FIST 4-match trial [1-6] where pupils receive 1 point where both match and reason given are correct and 0 otherwise
fist_4m_[1-6]cm	Discrete/ Nominal	Pupil's third response to match two boxes on FIST 4-match trial [1-6]
fist_4m_[1-6]cr	Discrete/ Nominal	Pupil's given reason for his/her third match on FIST 4-match trial [1-6] (options being colour, shape, number or size)
fist_4m_[1-6]cs	Discrete/ Dichotomous	Pupil score on his/her third match on FIST 4-match trial [1-6] where pupils receive 1 point where both match and reason given are correct and 0 otherwise
fist_4m_[1-6]dm	Discrete/ Nominal	Pupil's fourth response to match two boxes on FIST 4-match trial [1-6]
fist_4m_[1-6]dr	Discrete/ Nominal	Pupil's given reason for his/her fourth match on FIST 4-match trial [1-6] (options being colour, shape, number or size)
fist_4m_[1-6]ds	Discrete/ Dichotomous	Pupil score on his/her fourth match on FIST 4-match trial [1-6] where pupils receive 1 point where both match and reason given are correct and 0 otherwise
fist_4m_[1-6]s	Discrete/ Ratio	Pupil total score out of 4 on FIST 4-match trial [1-6]
fist_4m_s	Discrete/ Ratio	Pupil total score out of 24 on FIST 4-match trials
toh_3d_[a-f]1_pm_s	Discrete/ Ratio	Total number of permitted moves used by the pupil on trial [a-f] of the three-disk task
toh_3d_[a-f]1_rvm_s	Discrete/ Ratio	Total number of illegal moves attempted by the pupil on trial [a-f] of the three-disk task
toh_3d_[a-f]1_rvo_s	Discrete/ Ratio	Total number of other rule violations attempted by the pupil on trial [a-f] of the three-disk task
toh_3d_[a-f]1_tc	Discrete/ Dichotomous	Whether the pupil completed trial [a-f] of the three-disk task successfully or not
toh_3d_[a-f]1_score	Discrete/ Dichotomous	Pupil score for completing trial [a-f] of the three-disk task successfully where pupils receive 1 point for successful completion and 0 otherwise

toh_3d_ab_score	Discrete/ Ratio	Pupil total score out of 2 for successful completion of trials a and b of the three-disk task
toh_3d_bc_score	Discrete/ Ratio	Pupil total score out of 2 for successful completion of trials b and c of the three-disk task
toh_3d_cd_score	Discrete/ Ratio	Pupil total score out of 2 for successful completion of trials c and d of the three-disk task
toh_3d_de_score	Discrete/ Ratio	Pupil total score out of 2 for successful completion of trials d and e of the three-disk task
toh_3d_f1_start	Discrete/ Ratio	Time in seconds at which pupil started trial f of the three-disk task calculated from the time at which the enumerator started completing the assessment form
toh_3d_f1_end	Discrete/ Ratio	Time in seconds at which pupil completed trial f of the three-disk task calculated from the time at which the enumerator started completing the assessment form
toh_3d_f1_tt	Discrete/ Ratio	Total time in seconds that pupil took to complete trial f of the three-disk task, calculated as the difference between the recorded start and stop times
toh_3d_f1_rt_m	Discrete/ Ratio	Time in minutes for pupil to complete trial f of the three-disk task, taken from the stopwatch
toh_3d_f1_rt_s	Discrete/ Ratio	Time in seconds for pupil to complete trial f of the three-disk task, taken from the stopwatch
toh_4d_1_start	Discrete/ Ratio	Time in seconds at which pupil started the four-disk task calculated from the time at which the enumerator started completing the assessment form
toh_4d_1_pm_s	Discrete/ Ratio	Total number of permitted moves used by the pupil in the four-disk task
toh_4d_1_rvm_s	Discrete/ Ratio	Total number of illegal moves attempted by the pupil in the four-disk task
toh_4d_1_rvo_s	Discrete/ Ratio	Total number of other rule violations attempted by the pupil in the four-disk task
toh_4d_1_end	Discrete/ Ratio	Time in seconds at which pupil completed the four-disk task calculated from the time at which the enumerator started completing the assessment form
toh_4d_1_tt	Discrete/ Ratio	Total time in seconds that pupil took to complete the four-disk task, calculated as the difference between the recorded start and stop times
toh_4d_1_tc	Discrete/ Dichotomous	Whether the pupil completed the four-disk task successfully or not
toh_4d_1_rt_m	Discrete/ Ratio	Time in minutes for pupil to complete the four-disk task, taken from the stopwatch

toh_4d_1_rt_s	Discrete/ Ratio	Time in seconds for pupil to complete the four-disk task, taken from the stopwatch
lit_a_ex[1-3]	Discrete/ Nominal	Pupil response in letter identification task a example [1-3], being 0 (incorrect), 1 (correct) and 2 (no response/time expired)
lit_a_fl	Discrete/ Dichotomous	Whether or not the pupil correctly identified at least one letter in the first line of the table
lit_a_s	Discrete/ Dichotomous	Whether or not the pupil correctly identified at least four letters in the table overall
lit_a_tc	Discrete/ Dichotomous	Whether or not the pupil completed the task in less than 60 seconds
lit_a_s_t	Discrete/ Ratio	Where the pupil completed the task in under 60 seconds, the time shown on the stopwatch at the time of completion
lit_b_ex[1-2]	Discrete/ Nominal	Pupil response in word reading task b example [1-2] being 0 (incorrect), 1 (correct) and 2 (no response/time expired)
lit_b_fl	Discrete/ Dichotomous	Whether or not the pupil correctly read at least one word in the first line of the table
lit_b_s	Discrete/ Dichotomous	Whether or not the pupil correctly read at least four words in the table overall
lit_b_tc	Discrete/ Dichotomous	Whether or not the pupil completed the task in less than 60 seconds
lit_b_s_t	Discrete/ Ratio	Where the pupil completed the task in under 60 seconds, the time shown on the stopwatch at the time of completion
lit_[c-d]_fl	Discrete/ Dichotomous	Whether or not the pupil correctly read at least one word in the first sentence of the task [c-d] passage
lit_c_s	Discrete/ Dichotomous	Whether or not the pupil correctly read at least ten words of the task c passage overall
lit_[c-d]_tc	Discrete/ Dichotomous	Whether or not the pupil completed task [c-d] in less than 60 seconds
lit_[c-d]_s_t	Discrete/ Ratio	Where the pupil completed task [c-d] in under 60 seconds, the time shown on the stopwatch at the time of completion
lit_c_q[1-5]	Discrete/ Nominal	Pupil response to reading comprehension task c question [1-5] being 0 (incorrect), 1 (correct), 2 (no response) and 3 (not attempted)
lit_c_q[1-5]s	Discrete/ Dichotomous	Pupil score for reading comprehension task c question [1-5] where pupils receive 1 point for successful completion and 0 otherwise
lit_c_q_score	Discrete/ Ratio	Pupil total score out of 5 on reading comprehension task c

lit_d_q[1-5]	Discrete/ Nominal	Pupil response to reading comprehension task d question [1-5] being 0 (incorrect), 1 (correct), 2 (no response) and 3 (not attempted)
lit_d_q[1-5]s	Discrete/ Dichotomous	Pupil score for reading comprehension task d question [1-5] where pupils receive 1 point for successful completion and 0 otherwise
lit_d_q_score	Discrete/ Ratio	Pupil total score out of 5 on reading comprehension task d
drank	Discrete/ Dichotomous	Whether the pupil reported having drunk something before coming to school that day
ate	Discrete/ Dichotomous	Whether the pupil reported having eaten something before coming to school that day
meals	Discrete/ Ordinal	How many meals the pupil reported eating in a typical day
readmum	Discrete/ Dichotomous	Whether the pupil reported seeing his/her mother reading at home
readdad	Discrete/ Dichotomous	Whether the pupil reported seeing his/her father reading at home
readbro	Discrete/ Dichotomous	Whether the pupil reported seeing his/her brother reading at home
readsis	Discrete/ Dichotomous	Whether the pupil reported seeing his/her sister reading at home
readgranma	Discrete/ Dichotomous	Whether the pupil reported seeing his/her grandmother reading at home
readgranpa	Discrete/ Dichotomous	Whether the pupil reported seeing his/her grandfather reading at home
readunc	Discrete/ Dichotomous	Whether the pupil reported seeing his/her uncle reading at home
readaunt	Discrete/ Dichotomous	Whether the pupil reported seeing his/her aunt reading at home
readcous	Discrete/ Dichotomous	Whether the pupil reported seeing his/her cousin reading at home
readnonrel	Discrete/ Dichotomous	Whether the pupil reported seeing his/her non-relative guardian reading at home
readoth	Discrete/ Dichotomous	Whether the pupil reported seeing another person reading at home
famstress	Discrete/ Nominal	Which picture the pupil selected as representative of his/her typical home life, the options being 1 (stressful), 2 (affectionate) and 3 (no response)
house	Discrete/ Nominal	Which picture the pupil selected as representative of his/her home, the options being 1 (basic house), 2 (medium house), 3 (large house) and 4 (no response)
tuition	Discrete/ Dichotomous	Whether or not the pupil reported receiving regular tuition outside of school (in addition to

		family support with homework), the options being 0 (no tuition) and 1 (tuition received)
tutor	Discrete/ Nominal	Where the pupil reported receiving regular tuition outside of school, the type of tutor used
tutorother	String	Where the pupil reported receiving regular tuition from someone outside a specified category, the identity of the tutor
preptype	Discrete/ Nominal	The nature of any pre-primary schooling the pupil reported attending (if any)
lit_a_s_tot	Discrete/ Ratio	The total number of letters sounded by the pupil out of 100
lit_a_s_c	Discrete/ Ratio	The total number of letters sounded correctly by the pupil
lit_a_s_i	Discrete/ Ratio	The total number of letters sounded incorrectly by the pupil
lit_[b-d]_s_tot	Discrete/ Ratio	The total number of words read by the pupil in literacy task [b-d]
lit_[b-d]_s_c	Discrete/ Ratio	The total number of words read correctly by the pupil in literacy task [b-d]
lit_[b-d]_s_i	Discrete/ Ratio	The total number of words read incorrectly by the pupil in literacy task [b-d]
meat	Discrete/ Ordinal	How often the pupil reported eating meat in a typical week
fish	Discrete/ Ordinal	How often the pupil reported eating fish in a typical week
eggs	Discrete/ Ordinal	How often the pupil reported eating eggs in a typical week
milk	Discrete/ Ordinal	How often the pupil reported drinking milk in a typical week
multiling	Continuous	How many languages other than Kinyarwanda the pupil reported speaking at home
famread	Ordinal	How often the pupil reported seeing family members read at home from 0 (never) to 6 (everyday)
readwith	Ordinal	How often the pupil reported family members reading with him/her from 0 (never) to 6 (everyday)
books	Ordinal	The number of books the pupil reported the family having at home, the options being 0 (no books), 1 (no response), 2 (few books), 3 (medium number of books) and 4 (lots of books)
prepyears	Discrete/ Ratio	The number of years of pre-primary schooling the pupil reported having undertaken
famstruct	Discrete/ Nominal	The pupil's report family structure (for example, single-parent family, double-parent family)

repyears	Discrete/ Ratio	How many years of primary schooling the pupil reported having repeated
primyears	Discrete/ Ratio	How many prior years of primary schooling the pupil reported having undertaken
prioryears	Discrete/ Ratio	How many prior years of education (pre-primary and primary) the pupil reported having undertaken
afternoon	Discrete/ Dichotomous	Whether or not the pupil completed the assessment and survey in the afternoon
high_perf_school	Discrete/ Dichotomous	Whether the school attended ranked as a 'high-performance school' based on primary leaving examination results, compared with the other primary school sampled from the same district
nofamread	Discrete/ Ratio	The number of family members the pupil reported seeing reading at home
opra_perc	Continuous/ Ratio	Pupil score on the OPRA task as a proportion of the total trials that were correctly set (taking into account instances where, for example, one of the selection items was missing)

References for Measures Used

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