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Researching teacher multilingual-talk and student-benefits: rethinking knowledge blindness, diglossic cognition and its constructs

Bassey E. Antia[a] and Madu M. Bassi[a,b]

[a]University of the Western Cape, Bellville, Cape Town, South Africa; [b]Federal College of Education, Yola, Nigeria

ABSTRACT

Although supported by different ideologies of language, code-switching and translanguaging are, surprisingly perhaps, united in some of the claims made in their names. In the literature on classroom practices, one shared claim is that content is simplified for students when the teacher uses features enregistered as the non-official classroom language/s in a way that overlaps with and/or complements features enregistered as the official classroom language. Functional allocation of languages/features, a corollary of this claim, arguably interpellates what may be termed *diglossic cognition*. The problem with this diglossic cognition is that it is largely knowledge-blind and equates cognition with the mere use of particular languages or features. This study finds that there are both language and knowledge variables in teacher multilingual-talk that explain students' enhanced cognition, and, therefore, invites a rethink of the unnuanced connections made between language (feature) choice and cognition.

1. Introduction

Multilingual-talk by teachers in the classroom is a response to issues of learner diversity, inclusion and equity. Teachers attuned to the needs of their students have always striven to be linguistically response-able, even if they have sometimes done this surreptitiously (Probyn 2009; Marungudzi 2014). Code-switching and translanguaging stand out in theorizations of these teacher practices. What a few years ago seemed like a natural transition from a code-switching explanatory model to a translanguaging one is now contested terrain that is surfacing deep theoretical disagreements (Bhatt and Polonyai 2019; Otheguy, Garcia, and Reid 2018; Jaspers 2018; Ticheloven et al. 2019; Kiramba 2017).

There does not, however, appear to be much research examining how, taken together, both paradigms paradoxically overstate their claims on teacher multilingual-talk. In both paradigms, such talk is often discussed in terms of how, on analysis, a teacher is seen to draw on different or parallel language compartments to functionally allocate languages (code-switching) or to draw on features of an integrated and dynamic repository, albeit associated with different named languages (translanguaging), in order to mediate knowledge that is as a result believed to be understood better. Although arguments about knowledge (its decentering, its anchoring in lived experience, etc.) can be made under code-switching and translanguaging, both paradigms not infrequently emphasize only the choice of language or the use of features enregistered as particular named languages in making their claims. Linking knowledge benefits exclusively to the mere use of particular (features of

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CONTACT Bassey E. Antia ✉ bantia@uwc.ac.za

named) languages lacks perhaps more than just nuance. The claim controversially posits and essentializes a relationship between language and knowledge. It interpellates *diglossic cognition*, a form of division of linguistic labour in which features enregistered socially as language *x* support the processing of more cognitively demanding content, while features enregistered as language *y* do a different kind of cognitive duty.

Thus, a teacher operates with, or assumes the principle of, diglossic cognition when in their practice the unofficial classroom language appears to be associated with simplifying and clarifying things that were first stated in the official classroom language and believed to have been complex. Thus, content communicated in the unofficial language is expected to be simple, while no such simplicity is held up as a defining feature of the official classroom language.

In this paper we scrutinize diglossic cognition as can be inferred in that worldwide corpus of research that investigates how students benefit from teacher multilingual-talk. We consider what happens when the lens on teacher multilingual-talk is not exclusively on what language is used, so that the analytical focus can also be on knowledge and how language conveys it to improve learning or understanding and teaching. We ask how language- and knowledge-based variables in teacher multilingual-talk correlate with students' performance, taken as a proxy for cognition. While the link between a change in language/feature with the cognition variable of attention can be assumed, we problematize the link to such other variables as understanding and remembering.

We attempt to answer the above question on the basis of:

(1) recorded classroom lessons involving teacher multilingual-talk,
(2) the coding of lesson transcripts for named languages (language 1, 2, 3) and knowledge structure (polarities of semantic density, knowledge iteration),
(3) a set of questions, the answers to which are paired with relevant content within the lesson transcripts – coded as in (2) above, and
(4) statistical analyses of students' performance on these questions.

2. Claims and contestations of two paradigms

Code-switching, as Bhatt and Polonyai (2019) point out, is fairly uniformly defined across three major orientations to its research, namely, psycho-social, political-economic and conversational. It is uniformly seen as the alternation of languages or features of languages in the same interaction. It is ideologically committed to a notion of language(s) as multi-layered meaning potential. This meaning potential is realized transgressively by agentive language users in bi/multi-lingual or – dialectal settings in their pursuit of desired social or discursive indexicalities (e.g. affiliations, disaffiliations, speech repair, etc.). There is no disputing the ontological existence of languages as fixed meaning-making archives which, because they are not hermetically sealed, lend themselves to remixes in any number of ways for any number of purposes.

Translanguaging, in the diverse ways it has been used, is a practical theory of language (unified repertoire or linguistic system), a pedagogy, the observable use of language by multilinguals, and a vehicle of educational transformation that levels the performance playing field. It does so typically by breaking down barriers to learning and/or hierarchies of power (García and Wei 2014; Otheguy, García, and Reid 2015; Otheguy and García 2020). Underpinning the first three of the above four acceptations of translanguaging is a fluid, aggregated or non-boundaried conceptualization of language. A theory denying autonomous languages in the multilingual mind provides the rationale for a pedagogy that draws widely on the linguistic repertoire of learners without the value judgment of transgression; it thus validates, without the need for reference to a norm, the observed practices of multilinguals. These three dimensions of theory, pedagogy and practice are enlisted in a cause that seeks to transform educational institutions built on monolingual canons into (more) socially just spaces.

A code-switching critique of translanguaging is that the latter employs the very premise it questions (that is, the existence of different languages or of features which are associated with different languages) to make an argument against autonomous and boundaried languages. Translanguaging's post-Welsh emphasis on a unified repertoire is seen as impoverishing sociolinguistics research in the sense of erasing the semiotic (linguistic, cultural, social and historical) archives that sustain the study of certain social indexicalities (e.g. linguistic choice correlating with an affiliation or a disaffiliation decision). The translanguaging model of a unified repertoire is also seen as being at odds with research findings in neuro- and psycholinguistics around bilingual processing, bilingual production or bilingual aphasia, all of which are premised on there being separate codes (Bhatt and Polonyai 2019).

In turn, translanguaging finds that code-switching takes a third-person analytical perspective on first-person linguistic experience. For translanguaging, it is the person or user of language, rather than a preconceived notion of language, that should be the focus. Thus, the urban youth whose speech (as analyzed by the professional linguist) is shown to draw from different codes may not phenomenologically relate to such an analysis. Code-switching's emphasis on strategic and rational choice of codes is seen as flying in the face of individuals for whom multilingualism is a/their language, and who may not be aware or mindful of different codes undergirding their use of language. In assuming a transgression of norms (social, discursive, etc.), code-switching is seen as frequently treating the speech of multilinguals as 'marked', putting such individuals on the back foot. Translanguaging also finds support for its unified repertoire model of language in psycholinguistics research (Lewis, Jones, and Baker 2012; Wei 2018). The argument has, for instance, been made that 'the myriad lexical and structural features mastered by bilinguals occupy a cognitive terrain that is not fenced off into anything like the two areas suggested by the two socially named languages' (Otheguy, Garcia, and Reid 2018, 625).

In aspects of their application to classroom settings where there is an official language as well as other languages known by students and/or teachers, code-switching and translanguaging are paradoxically sometimes indistinguishable. Some authors (as will be seen subsequently) in fact write under the two different banners but make the same kinds of claims. While it is true that enforcing a preferred use of terminology is a tall order, it is nonetheless instructive to see how in the name of both paradigms a common claim has been made about there being a functional allocation of languages or language features in teacher-talk in multilingual classrooms. This allocation occurs according to a particular model: the official language is used by the teacher for the core instructional discourse or knowledge, while the task of simplifying, clarifying, explaining or otherwise breaking down this knowledge is achieved through the incorporation of the non-official classroom languages.

Thus, within research self-identifying as code-switching, claims have been made that closely mirror the view from Tanzania that teachers 'code switch (from English) to Swahili to clarify' (Shartiely 2016, 222), or from Hong Kong that teachers 'will use English once and use Cantonese to explain the content' (Wang 2019a, 131). See Table 1 for a selection of sources of such claims.

In self-styled translanguaging scholarship, the view that in a biology class in Finland, the 'teacher habitually provides L1 (Finnish) equivalents for key terms (in English), thereby apparently demonstrating a pre-disposition to translanguaging to support learning' (Nikula and Moore 2019, 242) holds true for teacher practices observed in Australia and Spain – two other countries in this three nation-study. This is very similar to a South Korean account indicating that, for teacher

Table 1. Functional allocation of languages in some international code-switching studies.

South Africa (Probyn 2009, 130)	Libya (Adriosh and Razı 2019, 5)
Taiwan (Tien 2009, 179)	Indonesia (Cahyani, de Courcy, and Barnett 2017, 470)
Burundi (Ndayipfukamiye 1996, 43)	Vietnam (Grant and Nguyen 2017, 250)
Malaysia (Bhatti, Shamsudin, and Said 2018, 19)	Singapore (Gwee and Saravanan 2018, 127)
Nepal (Sharma 2006, 84)	Nigeria (Igboanusi and Peter 2016, 566)
Estonia (Zabrodskaja 2008, 104)	US (Riegelhaupt 2000, 210)

Myung Jin, teaching 'new linguistic items that proved challenging often meant that she (the teacher) would translanguage (from English to Korean)' (Rabbidge 2019, 1315). Similar views have been documented in a number of other international studies. See Table 2.

This account of diglossic cognition neglects knowledge. It corresponds to an approach that has been criticized in the sociology of knowledge in education. Maton (2013, 2020) regrets the tendency in many fields for claims to be made about knowledge on the basis of little or no engagement with knowledge, a phenomenon he refers to as *knowledge blindness*. Maton argues that '[m]uch research into education is characterized by "knowledge-blindness": knowledge as an object of study is obscured' (Maton 2020, 60). This knowledge blindness leaves 'knowledge under researched, the study of education underdeveloped, and the sociology of knowledge unaware of its ostensible object of study' (Maton 2014, 4). An aspect of Maton's proposal is considered in the next section.

3. Towards knowledge analytical frameworks for teacher multilingual-talk

Two promising frameworks for surfacing knowledge dimensions in the analysis of teacher multilingual-talk are theories of legitimation code (Maton 2020) and of repetition effects in learning (Hintzman and Block 1971; Hintzman 2010; Knittel 2019).

3.1. Legitimation code theory: the semantics dimension

Maton's Legitimation Code Theory (LCT) 'explores the effects of different forms taken by knowledge practices' (Maton 2020, 62). The semantics dimension of LCT is an analytical toolkit for understanding how meaning-making takes place, or how knowledge is packaged and unpacked. It draws on Bernstein's idea of horizontal knowledge and hierarchical knowledge structures (Maton 2013, 11), and proposes that knowledge can be packaged on a continuum whose ends are specified in terms of degrees of meaning abstraction and meaning condensation. Correspondingly, LCT semantics operates with two codes, namely, semantic gravity (SG) and semantic density (SD), each of which has two polarities or charges (+ and −).

Semantic density, which for ease of illustration is adopted in this study, describes the degree to which knowledge or meaning is condensed in a particular unit (term, clause, etc.). A unit labelled SD + is one determined in a particular frame of analysis as not immediately comprehensible, as abstract, less context-dependent, and as requiring explanation that may sometimes course through several discursive moves for it to be understood. Stated differently, such a unit is readily meaningful only to a knower who possesses layers of previous domain-relevant knowledge. The converse of the foregoing would apply to a unit that is coded SD−. The effort in this paragraph to make 'semantic density' clear to the reader illustrates that, as authors, we have constructed this term as an SD+ code which needs to be unpacked to an SD− code for our readers.

In an introductory science class, 'NaCl' or 'Sodium Chloride' would be coded SD+ and have to be unpacked across multiple layers of meaning in order to be understood. Such discursive moves would not be necessary for the less condensed 'table salt' (SD−) in respect of which for the particular audience there would hardly be any layers of knowledge to be unpacked (Antia and Kamai 2016).

The application of these codes to knowledge in text or talk gives rise to semantic profiles, which are visualizations of knowledge structures. Maton (2013) identifies several profiles. In Figure 1, which

Table 2. Functional allocation of languages in some translanguaging studies.

South Africa (Probyn 2019, 225–226)	Malta (Farrugia 2018, 105–106)
China (Wang 2019b, 144)	Puerto Rico (Mazak and Herbas-Donoso 2015, 706)
US (Allard 2017, 121)	Indonesia (Rasman 2018, 691)
Qatar (Hillman, Graham, and Eslami 2019: no pagination)	Poland (Romanowski 2019, 18, 20)
Sweden (Jonsson 2019, 334)	Netherlands (Duarte 2020, 243)
Mexico (Schissel, De Korne, and López-Gopar 2018, 10)	Turkey (Yuvayapan 2019, 688)
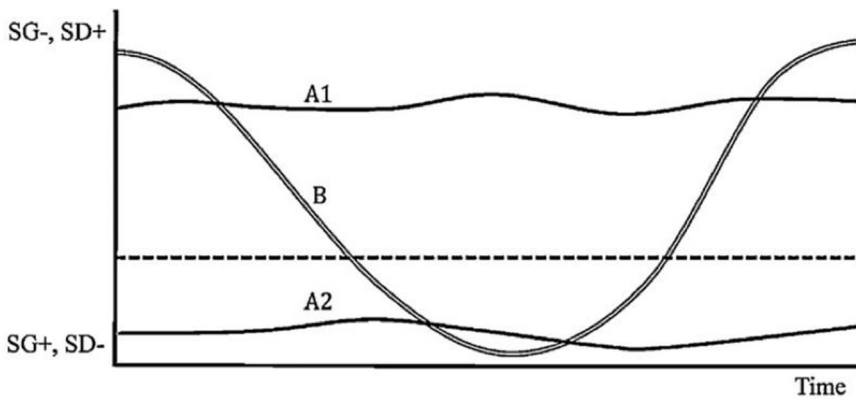
Figure 1. Composite representation of three semantic profiles (adapted from Maton 2013).

is a convenient composite representation, the profile referred to as high semantic flatline is represented by A1; semantic wave by B; and low semantic flatline by A2.

In Figure 1, the Y-axis depicts scale of strengths of the codes, while the X-axis depicts time (knowledge progression in text or talk). At A1, the *high semantic flatline*, meaning-making is taking place at a less explicit level, with a lot of technical information and terms that may be difficult to understand by non-specialists. In contrast, at A2, the low semantic flatline, meaning is made at a more explicit level. On B, meanings are made with stronger and weaker codes successively in order to create an undulating pattern called semantic waves.

An important claim of LCT Semantics is that knowledge competence is inculcated in students when positive and negative charges of semantic density are alternated. Thus, in an introductory science class, a positive charge (e.g. 'Sodium chloride') may be scaled down to a negative charge ('salt') for understanding to take place. Once understanding has been secured, the imperatives of talking or writing like one who has been inducted into a discipline (e.g. chemistry) would often require a positively charged repackaging ('Sodium chloride') of the unit of knowledge in subsequent references.

In pedagogical contexts, LCT Semantics has been illustrated monolingually. This monolingual bias has the advantage of underscoring the point that the positive and negative semantic density charges of a knowledge item do not have to correspond to different named languages. In sum, LCT Semantics provides a toolkit for analyzing knowledge on its own terms, independently of any specific language/features. It makes possible an investigation of the prospect that, in teacher multilingual-talk, knowledge of varying scales of strength can be expressed in (features enregistered as) the non-official classroom language – in the same way as the official classroom language can convey meanings on different scales of strength.

The implication of this latter point needs to be drawn out: LCT Semantics offers an analytical standpoint for multilingual teacher-talk which does not begin with assumptions of any form of knowledge being naturally or ideally expressed in a particular language as some research is wont to suggest. LCT is, therefore, suitable for examining claims of functional language allocation in both translanguaging and code-switching that appear to link knowledge benefits to the mere use of particular languages or features, and that, therefore, imply a diglossic process of knowing.

3.2. Repetition and learning

A theory of repetition effects in learning and memory formation usefully draws attention to a variable other than language choice in accounting for the claimed impact of multilingual teacher-talk on

students. The effect of repetition on learning as reflected in cognitive processes of attention, memory and retrieval has been hypothesized in two ways traditionally (Hintzman and Block 1971). The strength hypothesis has it that in the human memory there is one location for an event or idea. That location is called a memory trace. Every repetition of the idea has the effect of strengthening the memory trace representing that idea. Traces that are stronger are in turn more easily retrieved. Placed within the classroom, the strength hypothesis would suggest that what co-facilitates the student's learning and recall is the extent of repetition of content. Repetition thus becomes not just a trigger for information to be attended to, but also a modality for strengthening of brain cell connections on the basis of which learning takes place and memory is formed (Hintzman 2010; Knittel 2019).

On the other hand, the multiple trace hypothesis holds that every iteration of an event or idea creates a new memory trace, with a set of indexicalities of context. In other words, repetition of an idea produces multiple traces and their contexts in memory. On this view, learning is enhanced because one or a few of the multiplicity of traces can serve as convenient buoy for the learner to moor understanding or recall of content (Hintzman 2010).

Irrespective of whether the effects of repetition are expressed in terms of strength or of frequency, what both accounts do is underscore content repetition as a variable of teacher-talk that could affect understanding/recall. Both accounts encourage us to ask: in contexts where teacher multilingual-talk is credited with certain effects, would repetition (in the same named language) but perhaps with variation (linked to semantic densities) produce comparable effects? Together with polarity charges of semantic density, content repetition is a knowledge variable (language-independent) that is relevant to a determination of the impact of teacher-talk on students. It is against the backdrop of these theoretical insights that we subject to scrutiny the claims and inferences of diglossic cognition.

4. Materials and methods

4.1. Data sources

To obtain insight into the role of language and knowledge variables in the claimed cognitive benefits of teacher multilingual-talk for students, taught lessons in business ($n = 4$) and science ($n = 8$) were observed and audio-recorded at 4 high schools in Yola, Northeast Nigeria, as part of a broader study (Bassi 2021) approved by the Humanities and Social Science Ethics Committee of the University of the Western Cape (H/S/17/3/20). Another source of data were students' answers to written quizzes which were set, administered (and graded) by teachers on the basis of taught lessons within 2 days of the lessons. With the self-evident caveat that students' knowledge could have come from sources other than the lessons, the focus of the analysis was to relate students' performance to specific quiz items whose answers in the lessons had different configurations (language choice, semantic density charge, level of iteration). The interest, thus, was in determining whether there would be correlations (and of what kind) between students' performance and each of these variables.

English is the official medium of instruction at the study sites, but teachers frequently employ Hausa and Fulfulde which are widely spoken as both home and vehicular languages in Yola. A majority of the students in the study understand both languages.

4.2. Data coding

To obtain a profile of the lessons, which would later be linked to the quizzes and student performance, lesson transcripts had to be coded for (1) semantic density polarities; (2) language; and (3) repetition.

4.2.1. Coding for LCT semantics: semantic density

Keywords or terms in teacher-talk were coded (for SD+ and SD−) and discussed by both authors. The focus on keywords or terms was premised on the idea that terms/keywords are the building blocks of knowledge (Antia 2000). This implies that often questions (e.g. What depletes the ozone layer?) and the answers to them will articulate around these keywords/terms.

Coding for semantic density was done in two complementary ways. In a discourse analytical perspective (largely the teacher's), theme-rheme relations in teacher-talk were determined. Relevant probes included what the teacher framed as theme and the teacher's reformulations. Reformulation is a psychological act in which a speaker re-expresses, through a form Z (often but not always SD−), a unit of knowledge X that had previously been expressed through a form Y (often but not always SD+). Z could take the form of any of a synonym, definition, instance, explanation, etc. (Chukwu and Thoiron 1989; Martinot 2015). A second coding perspective was based on world knowledge inference. Underpinning this perspective was the question of what a student group in a given environment might reasonably be expected to understand/not to understand by close watchers of that environment (Cozijn, Noordman, and Vonk 2011; Singer and Ritchot 1996).

In the transcript excerpt below, the business teacher constructs 'occupation' as the theme of the utterance, which world knowledge inference also suggests can reasonably be coded SD+; the teacher then says something about this theme, making use of words coded SD− on the basis of world knowledge.

> If we say occupation (SD+), we mean the work (SD−) which people do to earn a living (SD−), whether the work (SD−) is temporary (SD−) or permanent (SD−).

In the next example, the science teacher positions 'depletion of ozone layer' thematically; its coding as SD+ is similarly supported by world knowledge. The rhematic account makes use of two further terms, with the more generic 'gases' (SD−) being reformulated into a more specific and dense 'chlorofluorocarbons' (SD+).

> The causes of depletion of ozone layer (SD+) could be found in the release of gases (SD−) known as Chlorofluorocarbons (SD+)

4.2.2. Coding for languages

As clauses frequently contained features from different named languages, the convention adopted was that a clause is identified with the matrix language and also has a greater number of coded keywords/terms. In the example below, the clause is coded Hausa because Hausa is the matrix language and there are more keywords in Hausa than in English (3–2).

> Cututtukanda (SD−)[1] ake samu ta ruwanda ba kyau (SD−)[2] sune, Typhoid (SD+)[3] ahhh, da Ammai da gudawa (SD−)[4] da da daaa da Cholera (SD+)[5], ko? {Hausa language for: Diseases[1] that can be contacted through unclean water[2] are typhoid[3] mmmh and vomiting and stooling[4] and and cholera[5], right?}

4.2.3. Coding for content iteration

Coding here was done at a global lesson level, and limited to those lesson transcript segments (irrespective of language) that were relevant to answering quiz items. Although it has shortcomings, the following convention was adopted: if, at term or clause level, the content that was integrally or partially relevant to answering a question was iterated up to three times, this would be considered low-level iteration (LiT); if, however, such content was iterated four times and above, this would be considered high-level iteration (HiT). Consider the set of excerpts in Textbox 1 taken from different parts of a lesson transcript on the ozone layer.

Textbox 1. Transcript excerpts illustrating iteration.

- <u>Ozone</u> (SD+) is a <u>colourless unstable gas</u> (SD+).
- So, <u>ozone layer</u> (SD+) is a <u>thin layer of gas</u> (SD+) high above the earth's surface which helps to protect the earth from sun's <u>harmful rays</u> (SD+).
- {Hausa} To, <u>ozone layer</u> (SD+) shine <u>shimpidi iskar gas</u> (SD+) <u>wanda yake kare zafin rana akan kasa</u> (SD-) {glossed as: Ozone layer is a layer of air gas that protects the earth from sun rays}.
- {Fulfulde} Lalle a wawii. <u>Hendu gas</u> (SD−) kwo suddi duniyaru {glossed as: You really understand. Gas that covers the earth}.
- <u>It protects us from the sun's heat</u> (SD−).
- {Hausa} <u>Ozone layer</u> (SD+) yana nan kamar gas (SD+) ne bazamu iya gani da idanunmu ba {glossed. as: Ozone layer is gas that we cannot see with our naked eyes}.
- <u>We cannot see it with our eyes</u> (SD−), ko? {ko is Hausa for: right?}.

Textbox 1 illustrates high-level content iteration (HiT): there are some seven predicates that can be derived for 'ozone/ozone layer', two of which are in Hausa, one in Fulfulde and the remainder in English.

Teacher quizzes in both subjects had items such as: (i) explain the effects of drug abuse on our youth; (ii) explain three properties of a compound; (iii) define ozone layer; (iv) name any three diseases that are transmitted by water; (v) discuss briefly how to control the depletion of ozone layer; (vi) define occupation; (vii) state any four types of occupation that people do in your community; (viii) explain two forms of business; (ix) with an example, how do you determine a net profit and a net loss? The graded scripts and scores were made available to one of the researchers (MMB) who extracted relevant information for each student, and tabulated the score per question.

4.2.4. Data analysis

With the transcribed lessons coded in the manner described previously, it became possible to obtain a profile of the semantic density, language and iteration profile of answers (available in the lessons) to specific questions. Thus, with a question on the definition of the ozone layer, it was clear what language/s had been (most) employed by the teacher while teaching this topic, what the semantic density polarities were and how much iteration there was.

The above coding and tabulation processes were used to generate the lesson content variables, which were developed as follows: (i) lesson content relevant to answering task questions was predominantly expressed in Hausa and/or Fulfulde; (ii) lesson content relevant to answering task questions correctly was predominantly expressed in English; (iii) lesson content relevant to answering task questions correctly was predominantly coded SD+; (iv) lesson content relevant to answering task questions correctly was predominantly coded SD−; (v) lesson content relevant to answering task questions correctly had high level of repetition. Items (i)–(ii) are language-related variables, while items (iii)–(v) are language-independent variables.

Two statistical analyses were performed. A Pearson correlation analysis was performed to determine the relationship between the students' performance and lesson content variables. A *p*-value analysis was conducted to establish the statistical significance of the results. With respect to the Pearson correlation, a positive relationship is obtained when the correlation is greater than 0. Now, whether the positive correlation is strong or weak is determined as follows:

- correlation value between 0.00 and 0.19 = very weak
- correlation value between 0.20 and 0.39 = weak
- correlation value between 0.40 and 0.59 = moderate
- correlation value between 0.60 and 0.79 = strong
- correlation value between 0.80 and 1.00 = very strong

For the *p*-value test of statistical significance, we formulated the following hypotheses:

(1) Null hypothesis: The performance of the students is not influenced by the variables.
(2) Alternative hypothesis: The performance of the students is influenced by the variables.

If the *p*-value is sufficiently low (less or equal to 0.05) the null hypothesis is rejected, while the alternate is accepted. Rejecting the null hypothesis means there is a linear relationship between a lesson variable and students' performance.

5. Findings and discussion

Table 3 below shows the correlation results between each of the lesson variables and the students' performance as well as the *p*-value.

At a glance, we see from Table 3 that all the correlations are positive but generally weak, which is a reflection of the small data size. With this in mind, then, the most interesting aspect is the degree of strength of the correlations as well as their statistical significance.

Table 3 strongly evidences that for lesson variable 1, the correlation to students' performance was weak, positive and statistically significant. There is, in other words, definitely a linear relationship between Hausa/Fulfulde and students' performance. Regarding variable 2, that is, the dominant use of English, its positive correlation to students' performance was weaker (0.188) than the correlation involving variable 1. In addition, this much weaker correlation was not statistically significant as shown by the *p*-value. Therefore, English, the official classroom language, was less an enabler of good performance than was Hausa/Fulfulde. The findings of both of these language variables constitute the staple of code-switching and translanguaging research.

Let us turn to the knowledge variables, which in the current literature on classroom translanguaging and codeswitching, have received little attention but hold great potential to shed light on factors other than language that influence students' cognition. Taking variables 3 and 4 together, Table 3 shows that the positive correlation of an SD+ charge was weaker than the correlation of the SD− charge, which with a *p*-value of 0.062 might have also been statistically significant with a larger data set. The idea in these results which needs to be followed up is that the more the lesson content is unpacked (less dense) the better students will perform on questions whose answers can be found in the unpacked lesson segments.

With respect to variable 5, content iteration, it has a weak positive correlation with students' performance, but the correlation is statistically significant. There is, in other words, definitely a linear relationship between the number of times relevant content (for answering a question) is iterated and the performance of students.

On the basis of these results, the null hypothesis is rejected and the alternate accepted on one variable each in the language and the knowledge categories; in other words, in respect of the data for the predominant use of Hausa/Fulfulde and of content iteration in the lessons, we reject the null hypothesis that these variables do not influence the performance of the students. We are

Table 3. Correlation results and statistical significance.

Lesson variables	Correlation value	Sig. (*P* value)
1. Lesson content relevant to answering task questions was predominantly expressed in Hausa and/or Fulfulde	0.278	0.050
2. Lesson content relevant to answering task questions correctly was predominantly expressed in English	0.188	0.191
3. Lesson content relevant to answering task questions correctly was predominantly coded SD+	0.142	0.326
4. Lesson content relevant to answering task questions correctly was predominantly coded SD-	0.266	0.062
5. Lesson content relevant to answering task questions correctly had high level of repetition in lesson relevant to answering correctly	0.288	0.043

unable to similarly reject the null hypothesis on the other three lesson variables, despite the positive correlations.

These findings invite a rethink of the unnuanced and almost essentialized connections made between language (feature) choice and cognition in the studies reviewed earlier. The findings confirm that cognition is about more than just language (feature) choice. To varying levels, two language-independent variables, viz. content iteration and negative semantic density charge, appear to be promising as complementary explanations for the cognitive benefits of teacher multi-lingual-talk in the classroom. To return to the positive correlations between language and cognition, although in this study we did not investigate what makes language produce the effects observed, a previous comparable study (Antia 2017) did point to the knowledge underlay of the so-called language (feature) factor: perspective, foregrounding, frame and related issues around construal as understood in cognitive linguistics; motivation (semantic and morphological); frequency and context within which terms are encountered in the languages/features in question.

It is facile to suggest that non-official classroom languages, perhaps because they may not have a pedigree of extensive deployment within particular traditions of knowledge production and communication, are necessarily coterminous with content simplification (that is, negative semantic density). This study calls for interpretative caution because a change in named language does not necessarily always lead to better understanding or simplification of content. In other words, better understanding ascribed in the literature to a change of language could easily be about a change in semantic density polarity (e.g. positive to negative) or be the effect of repetition. No language has exclusive preserve of a specific polarity as can be seen in the semantic wave in Figure 2, a graphic modelling of the semantic density codes (SD+/-) and language identifiers of a lesson segment on the topic of the solar system.

As Figure 2 shows, the task of expressing the 32 knowledge units was divided equally between English and Hausa/Fulfulde. Of the 16 units encoded in English, 7 or 44% were SD+, while the remaining 56% were SD−. Regarding the other 16 units in Hausa/Fulfulde, 8 or 50% of these were SD+ and the other 50% were SD−. Evidently, neither SD+ nor SD− is the preserve of any language.

In the same way as semantic density polarity is not necessarily the preserve of any language, so is content iteration. Figure 3 represents the iteration seen earlier in Textbox 1.

Figure 3 shows that the nature of 'ozone' as gas (layer, colourless/invisible, unstable) is iterated thrice in English, twice in Hausa, and once in Fulfulde. The function of the 'ozone', protecting the earth, is stated twice in both English and Hausa, and once in Fulfulde. This high level of content
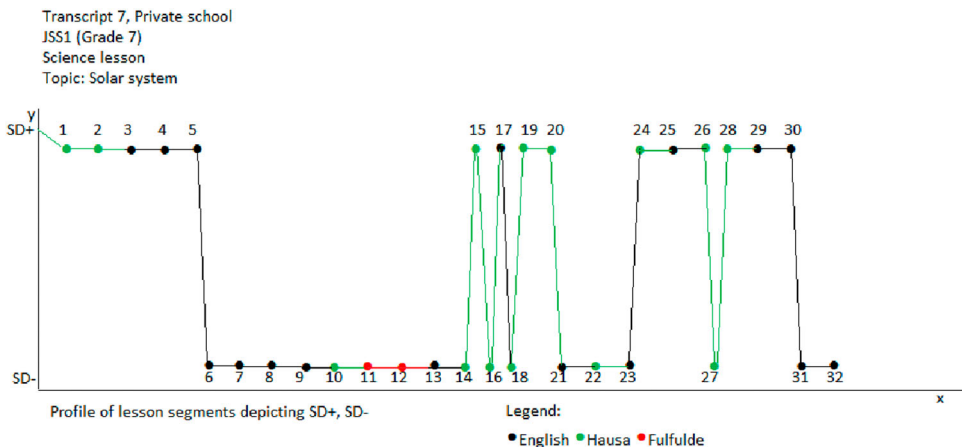

Figure 2. Semantic density charges are not the exclusive preserve of any particular language.
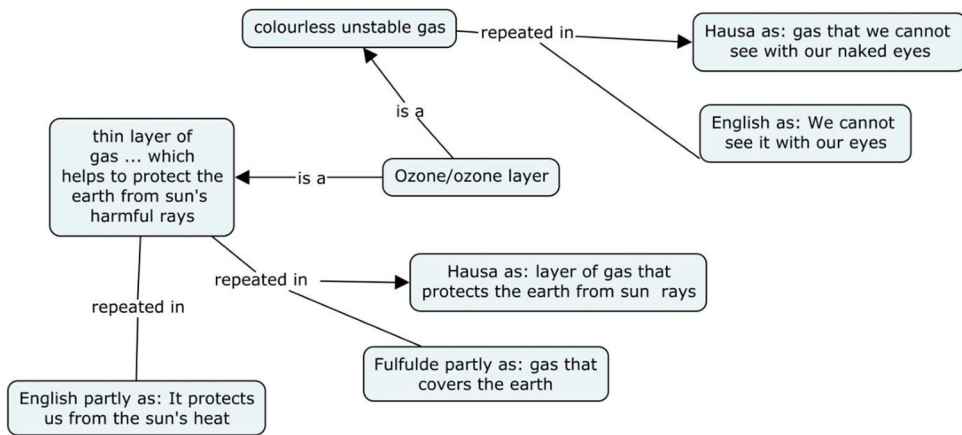
Figure 3. Content iteration is not the preserve of any particular language.

iteration (HiT) and the fact of 18 out of 20 students getting the answer fully or partially correct, are consistent with the claims of the strength hypothesis seen earlier.

The correlation between an SD− charge and enhanced student performance although positive was not statistically significant (the p-value of 0.062 is above the 0.05 threshold for significance). The fact of being positive remains instructive. Also, the fact of a positive correlation of an SD+ charge being weaker than the correlation of the negative charge (SD−) indicates that, irrespective of language of encoding, less densely packaged content appears to have more positive impact on student's cognition than more densely packaged content. Together, the findings invite more caution and nuance in the analysis and interpretation of data on teacher translanguaging or code-switching.

6. Conclusion

We conclude by addressing three set of implications: the research on and practice of multilingual pedagogy; the dichotomy between code-switching and translanguaging; and a southern epistemological lens on diglossic, perhaps heteroglossic cognition, in education.

With respect to the research on and practice of multilingual pedagogy, this study shows how a number of knowledge variables (semantic density polarities, content iteration) may be incorporated into the study of multilingual instruction in ways that engage much more substantively with knowledge than has been the case, even in some of the more attentive studies that operate with such dyads as: instructional versus regulatory discourses (Christie 1997); instructional versus procedural engagement (Nystrand and Gamoran 1991); conceptual versus procedural discourses (Setati 2005). Teaching and teacher-training in our study site can leverage the finding that the configuration of variables in teacher-talk that appears to have the most cognitive impact on students comprises (features enregistered as) English, Hausa and Fulfulde; a high level of content iteration; and content packaging whose semantic density is predominantly negatively charged.

With respect to the dichotomy between code-switching and translanguaging, this study has provided evidence that questions the distinction while simultaneously highlighting certain questions and imperatives. First, it does not appear that a determination can be made from examining a stretch of written or spoken text that the material exemplifies code-switching and not translanguaging, or vice versa. In other words, there are as yet no known features of text which gesture towards one rather than the other accounting framework. The clue may well lie in the metadiscourse (see the third point below).

Second, to ensure ideological commitment to a given paradigm, studies that self-identify as translanguaging or code-switching may well have to come under increased scrutiny to determine how

they are aligned with a set of underlying theoretical ideas. Currently, claims of identification with one or the other paradigm are not known to have been repudiated or to have elicited disclaimers along the lines of 'not in my name'.

Third, the basis for determining alignment needs to be further clarified. For translanguaging, this task has been done recently in a joint presentation by García and Otheguy (2022). Central to the clarification they offer is the distinction between what is cognitive and what is social. For them, languages (different named languages) exist socially, and regularly have attributed to them all sorts of social indexicalities (colonial exploitation, love, ideology of language hierarchies, etc.). However, in the mind there are no correlates for those 'terms and conditions' under which languages exist in society and have real world impact. There is, therefore, no contradiction in using named languages to argue for a unitary conception of language. The social and cognitive spheres are different. Language at a cognitive level needs to be disconnected from the indexicalities of language as social reality.

It is the discourse around a stretch of text that betrays the framework to which the text author/speaker or analyst is committed. Teacher-talk that is to be associated with translanguaging would be one that bears no traces of essentialized monolingual normative judgments, has no regard for putative language hierarchies or other essentialized language ideological indexicalities. Conversely, the metadiscourse around teacher-talk to be labelled code-switching will, among others, highlight a transgression of norms, even if this is understood as a liberatory political act.

In discussing a final implication, we adopt a southern epistemological lens on diglossic cognition in multilingual education. Southern Epistemologies is a counter-hegemonic, alternative or complementary account of knowledges and knowledge-making offered by and in solidarity with populations, irrespective of geographical locale, that have experienced systemic (internal or external) colonization and exploitation of their being, knowledge and resources. The Global South is, therefore, both a geographical and a phenomenological perspective (Antia and Makoni in press).

The functional allocation of languages in lines of code-switching and translanguaging scholarship has in the Global South arguably worked to perpetuate, consolidate or reinscribe a hierarchy of languages and peoples – which, admittedly, is contrary to García and Otheguy's recent understanding of translanguaging. While several languages may well be 'needed to convey the information', with each language 'used to convey a different informational message' (Blackledge and Creese 2010: 108), it often is the case in these southern environments that European languages are presented as conveying high-level content. Local languages are, in contrast, presented as best suited for simplifications and for ancillary functions (e.g. regulatory, preparatory discourses); they are scaffolds and transitional arrangements that have to be in place until appropriate levels of competence are attained in European languages.

A number of questions can be posed (cf. Antia 2021). In African education, does diglossic cognition, perhaps more appropriately heteroglossic cognition, (1) have to involve hierarchies of languages/language features, knowledges and knowers? (2) Is there a basis for describing heteroglossic cognition that involves only African languages? With the current understanding of code-switching and translanguaging in education, to what extent do these pedagogical devices do the following: (3) Prevent local languages from being tied to the apron strings of European languages? (4) Encourage much needed investments in the functional elaboration of local languages? (5) Stimulate a local (language) publishing industry?

Disclosure statement

Notes on contributors

Bassey E. Antia holds a PhD from the University of Bielefeld, Germany, and is a Professor in the Department of Linguistics at the University of the Western Cape, South Africa. He has research and teaching interests in, among others, language policy, multilingualism, terminology and decolonial approaches to sociolinguistics.

Madu M. Bassi holds a PhD in Applied Linguistics from the University of the Western Cape, South Africa. He is a Principal Lecturer in French at the Federal college of Education, Yola, Nigeria. He has research interests in Legitimation Code Theory (LCT), bi/multilingualism and terminology.

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