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BARRIERS TO THE INTEGRATION OF MOBILE DEVICES IN PHYSICS EDUCATION

INSIGHTS FROM CZECH UPPER-SECONDARY TEACHERS: INITIAL FINDINGS

TECHNOLOGY-SUPPORTED INQUIRY
TASKS CAN MEANINGFULLY CONTRIBUTE
TO STUDENTS' MOTIVATION,
CONCEPTUAL UNDERSTANDING, AND
DEVELOPMENT OF SCIENTIFIC PRACTICES

The International Handbook of Physics Education Research (Taşar et al., 2023)

BARRIERS TO THE INTEGRATION OF MOBILE DEVICE

- **First- and second-order barriers** (Ertmer, 1999)
 - External/system-level influences: lack of time, lack of financial resources, lack of equipment, lack of training
 - Personal influences: teachers' attitudes and beliefs, their self-confidence, ...
- **Technology acceptance model** (Marikyan & Papagiannidis, 2024)
- **Mobile Learning Readiness Scale** (Christensen & Knezek, 2018)
 - Possibilities
 - Benefits
 - Preferences
 - External Influences

CATEGORIES OF BARRIERS AND OPPORTUNITIES

FIRST ORDER

Technical Barriers
(e.g., lack of devices, poor Wi-Fi, technical problems)

Institutional Barriers
(e.g., school policies, lack of support, insufficient training)

SECOND ORDER





Pedagogical and Personal Barriers
(e.g., teacher beliefs, low confidence, reluctance to change practices)

Concerns about the Effect on Students
(e.g., distraction, reduced attention, misuse of smartphones)

Pedagogical Opportunities
(e.g., new teaching strategies, active learning, student engagement)

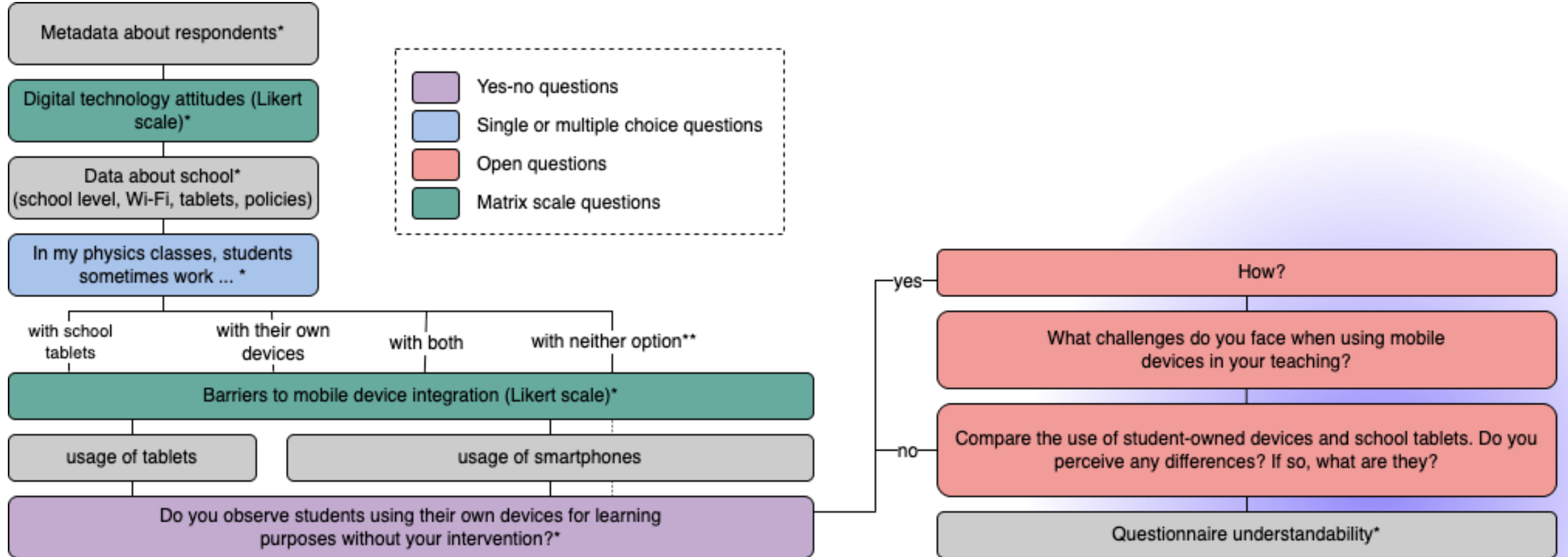
Personal Preferences
(individual teacher attitudes – not the full scale)

DATA COLLECTION

-  How? online questionnaire send out through e-mail
-  When? June & July 2025
-  Who? Czech lower and upper secondary physics teachers
contacts from our internal database of physics teachers (~2500)
courses for teachers provided by our department (128)
direct outreach to known teachers (~30)
-  Response rate: 343 respondents (approx. 13%)

QUESTIONNAIRE

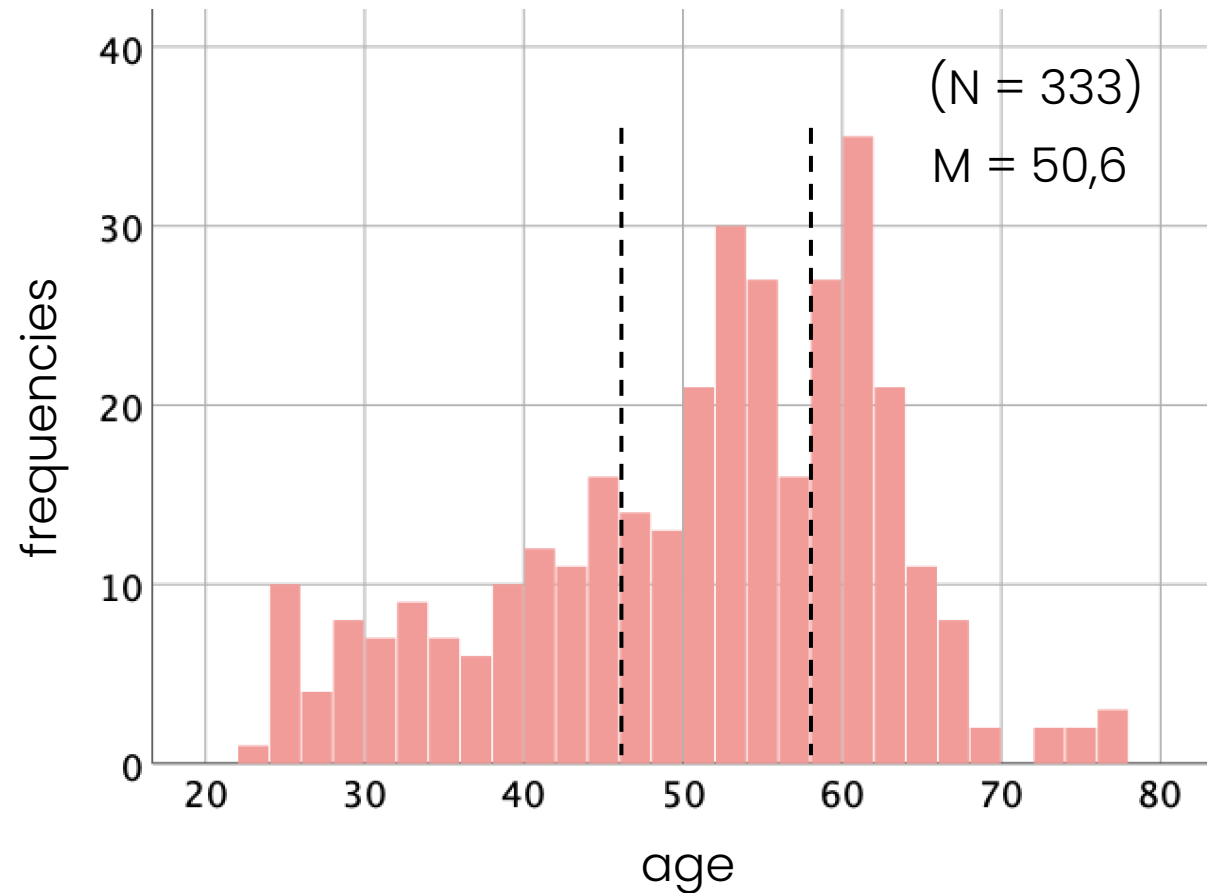
Aims: to map barriers, attitudes, and practices





RESPONDENTS

- N = 337 (6 respondents stated low understandability of the questionnaire – 2★ or lower)
- most respondents 50–65 years old
- not ideal sample, but was expected
- divided into 2 groups – third of the youngest and third of the oldest
 - from 23 to 47 y.o.
 - from 58 to 76 y.o.

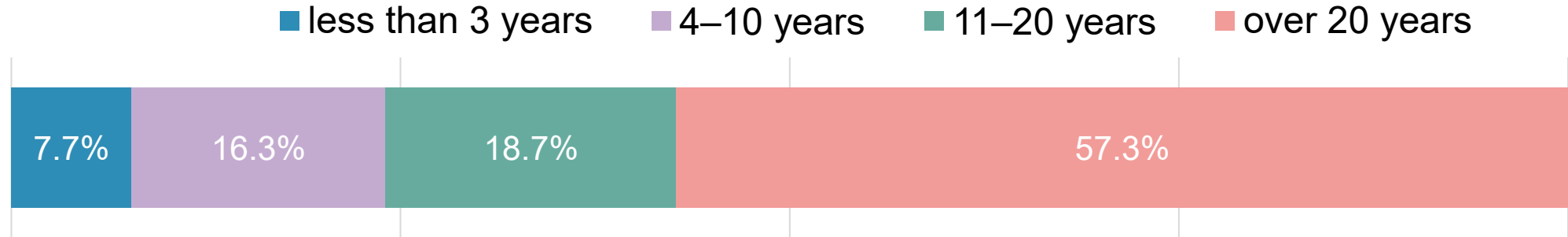




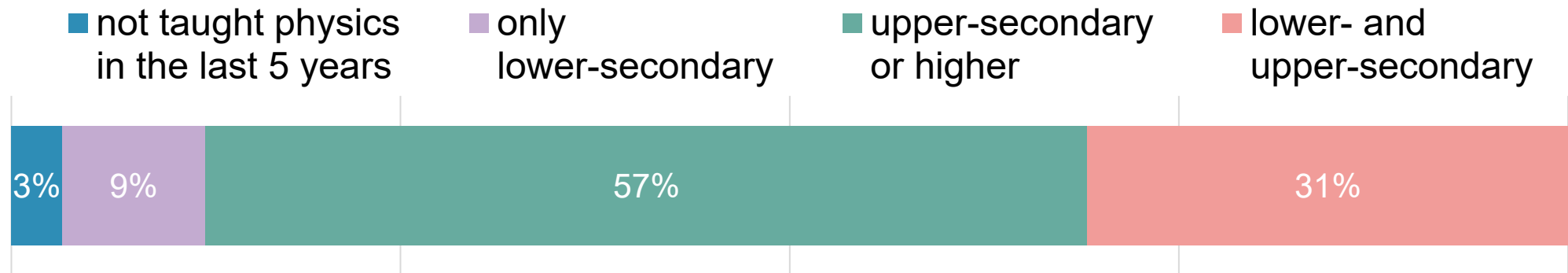
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Length of teaching experience (N = 337)



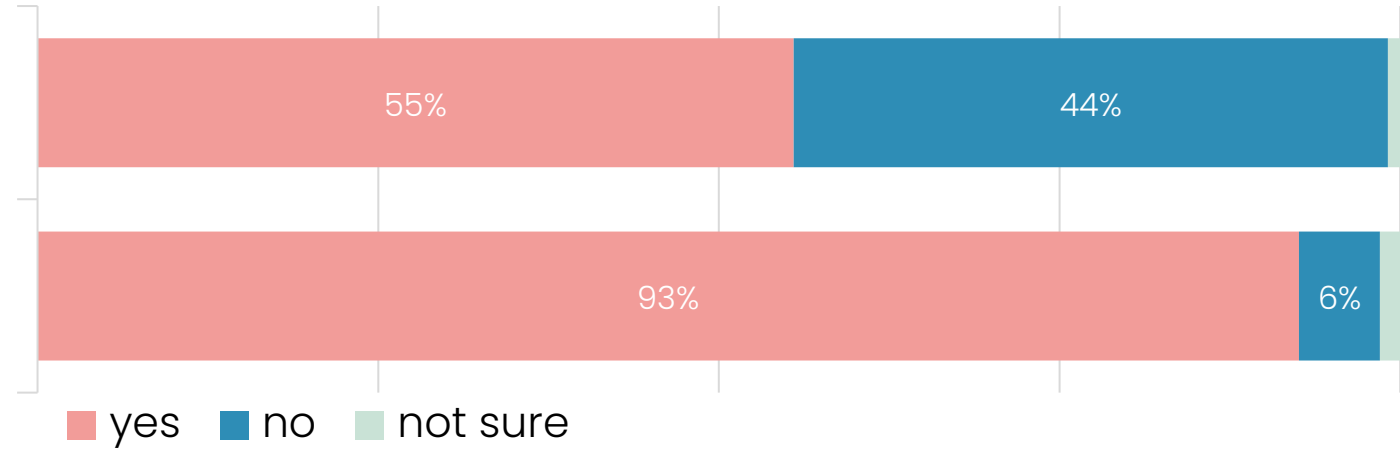
School level (N = 337)





Do you have access to school tablets?

Do students have access to the school Wi-Fi network?

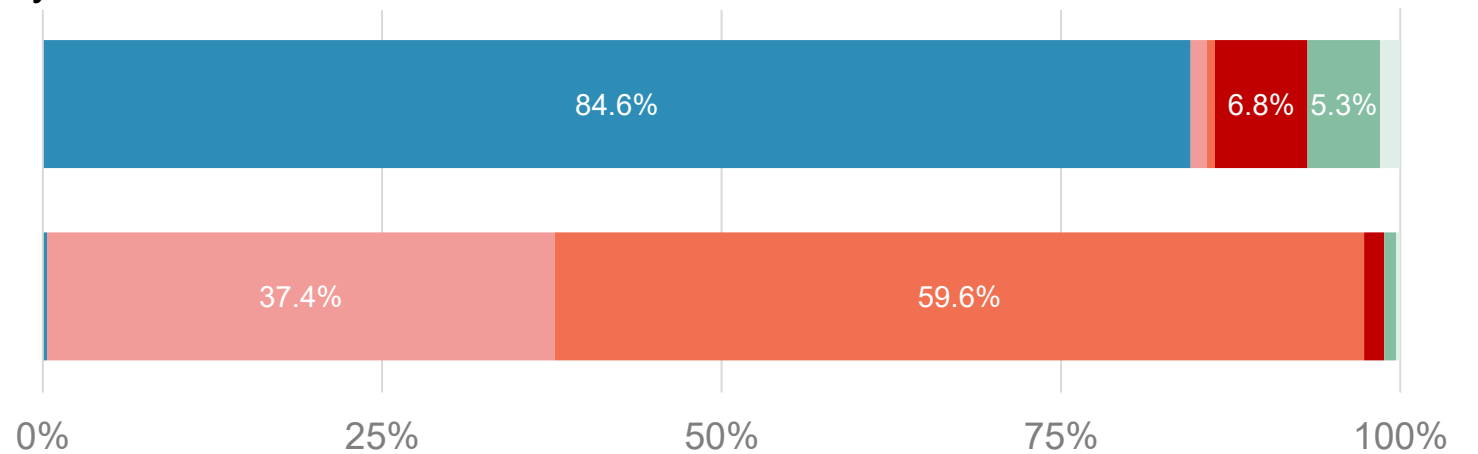


What are your school's policies on student device use? (N = 337)

■ No restrictions ■ For educational purposes only ■ Only when instructed by the teacher ■ Completely prohibited ■ Other policy ■ Not sure

during breaks

during lessons





EARLY FINDINGS

1. Fewer first-order barriers?: internet access common, tablets in ~50% of schools, student phones restricted by school policies in only 1.5% (our sample)
 - 47% of respondents do not use the provided tablets



digital technologies, N = 337

add variety

(M = 4.34, SD = 0.75)

make teaching easier

(M = 3.92, SD = 0.92)

organize work

(M = 3.61, SD = 0.97)

electronical notes

(M = 4.05, SD = 1.27)

ban

(M = 2.69, SD = 1.23)

time-consuming

(M = 3.12, SD = 1.04)

calculators not necessary

(M = 2.11, SD = 1.20)

e-books

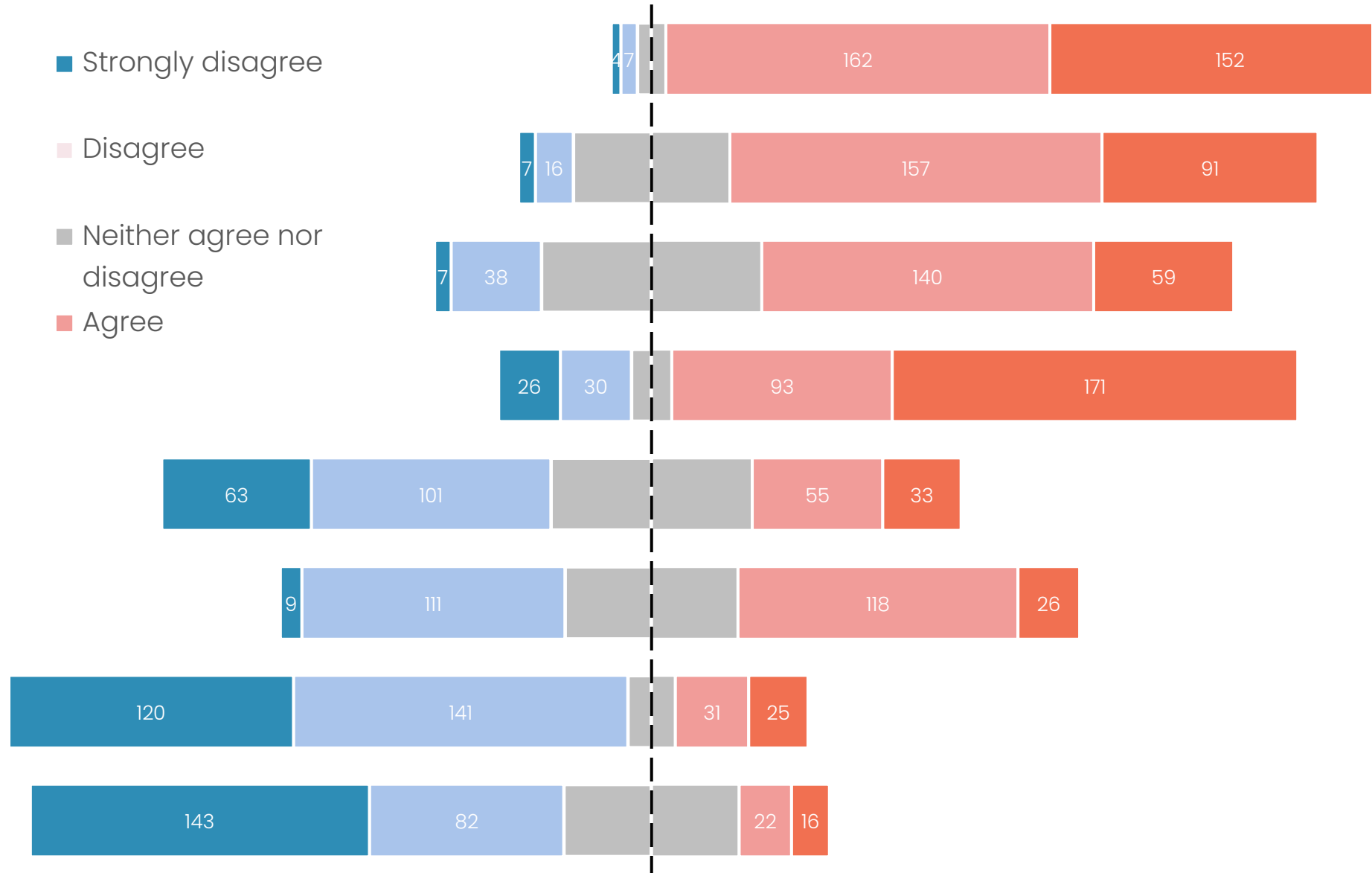
(M = 2.07, SD = 1.15)

Strongly disagree

Disagree

Neither agree nor disagree

Agree





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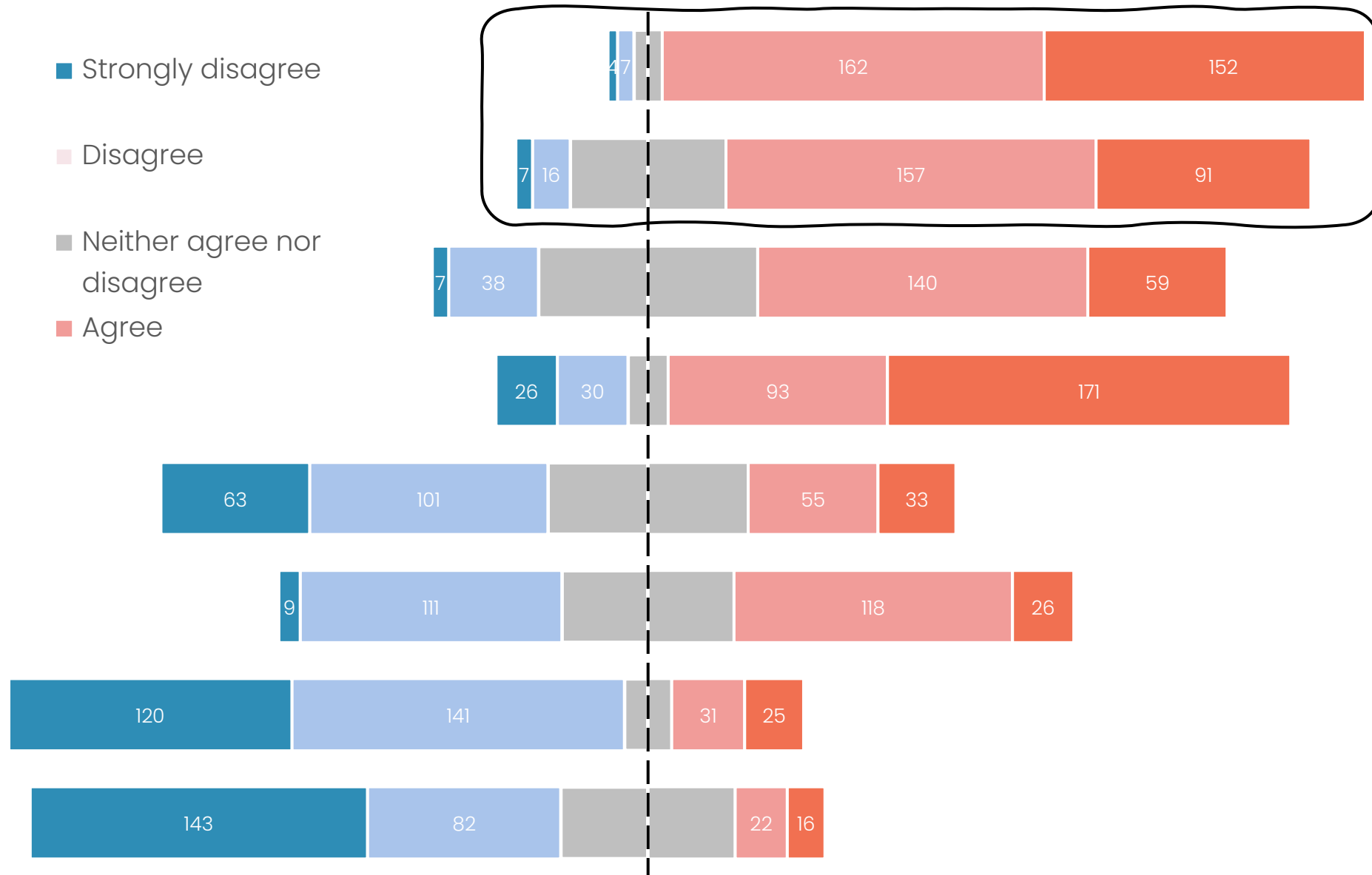
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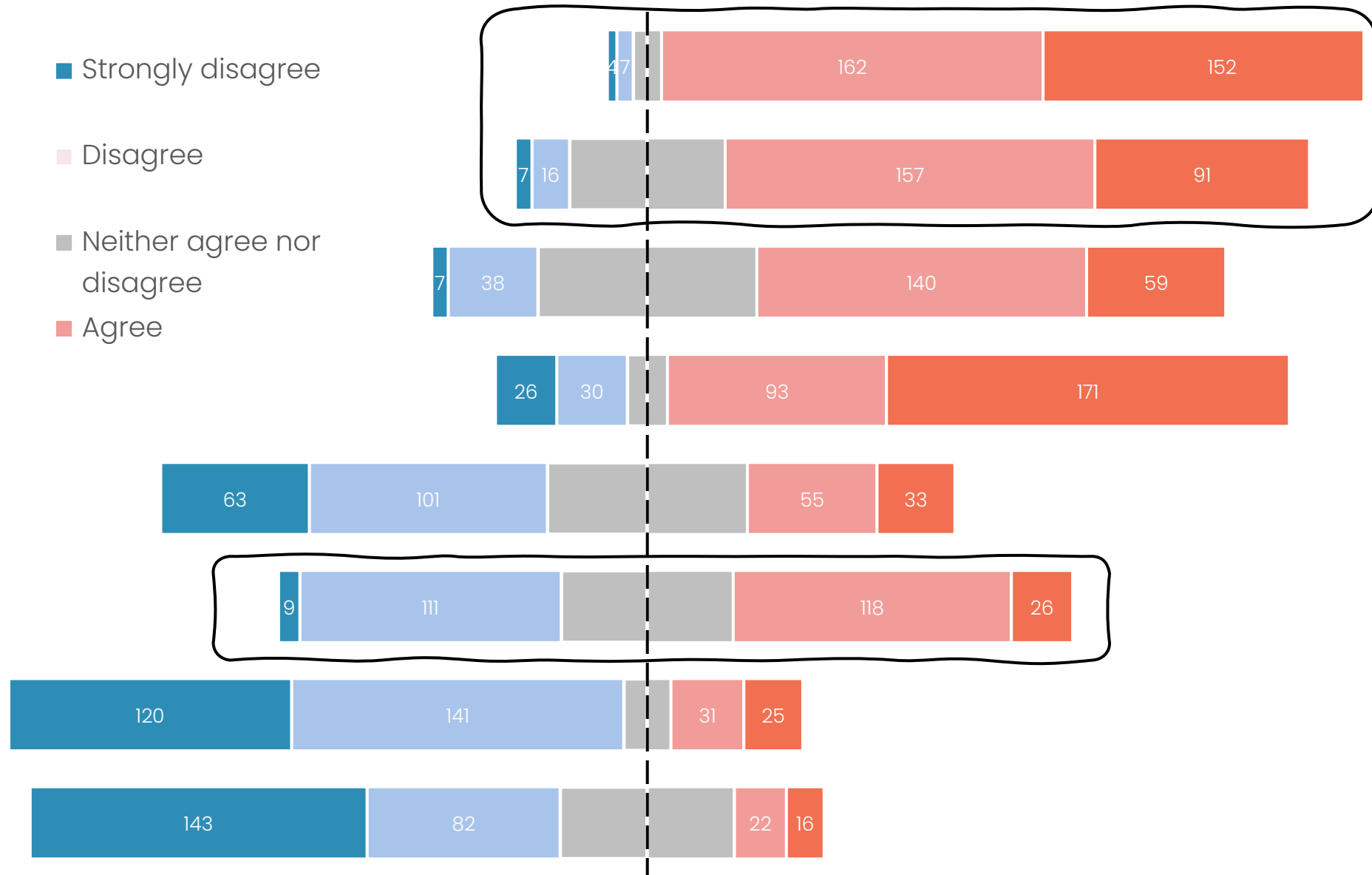
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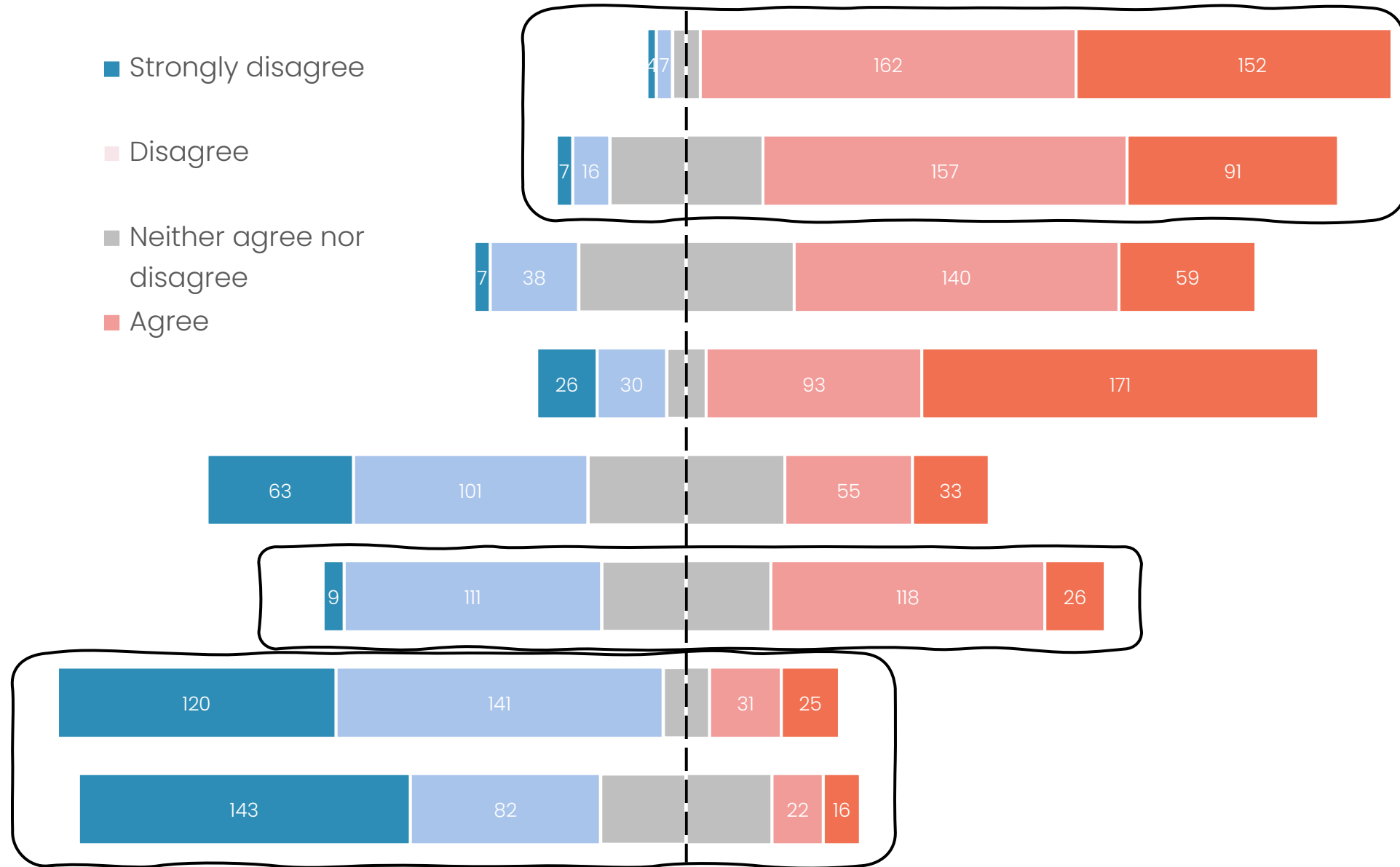
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EARLY FINDINGS

1. Fewer first-order barriers?: internet access common, tablets in ~55% of schools, student phones restricted by school policies in only 1.5% (our sample)
 - 47% of respondents do not use the provided tablets
2. Respondents recognize the potential of digital tools to make lessons engaging, but remain cautious about replacing traditional tools such as calculators.

Group comparisons (age, experience, school level)

Methods: t-test, one-way ANOVA, Games-Howell post-hoc (unequal group sizes)

- **Age:** only significant difference for e-books (older teachers more positive: $M = 2.24$ vs. $M = 1.85$, $p = .009$)
- **Experience:** mostly no clear trend
- **School level:**

	LSE only (N=31)	USE or higher (N=191)	both levels (N=104)	post-hoc p-values
Preparation time	2.65 ± 0.88	3.23 ± 1.11	3.11 ± 0.91	LSE-USE: .005; LSE-Both: .037
Electronic notes	2.84 ± 1.57	4.12 ± 1.21	4.39 ± 0.98	LSE-USE: <.001; LSE-Both: <.001
E-books	1.58 ± 0.92	2.18 ± 1.18	2.05 ± 1.17	LSE-USE: .007; LSE-Both: .061



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 - 47% of respondents do not use the provided tablets
2. Respondents recognize the potential of digital tools to make lessons engaging, but remain cautious about replacing traditional tools such as calculators.
3. In our sample, no significant differences by age or teaching experience are present – but at the school level, primary-only teachers see preparation as less demanding and are less open to electronic notes.



WHAT'S NEXT?

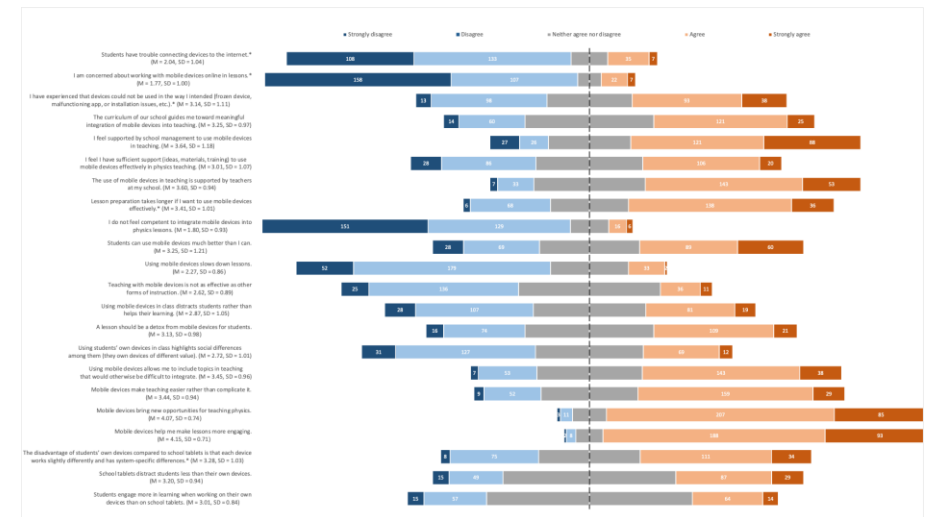
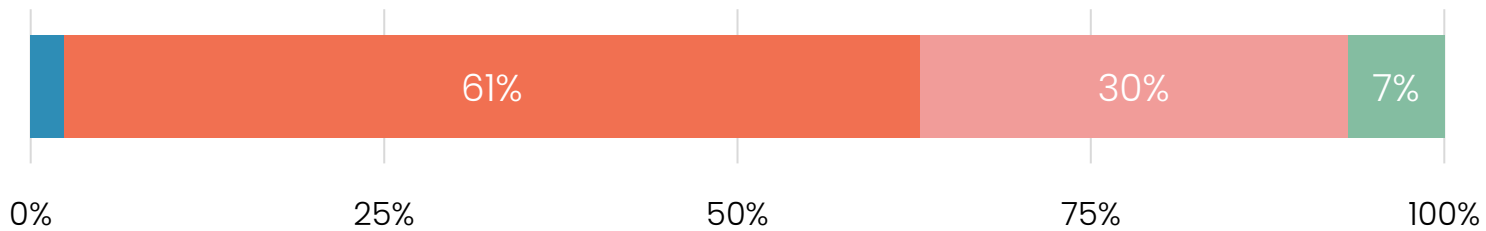


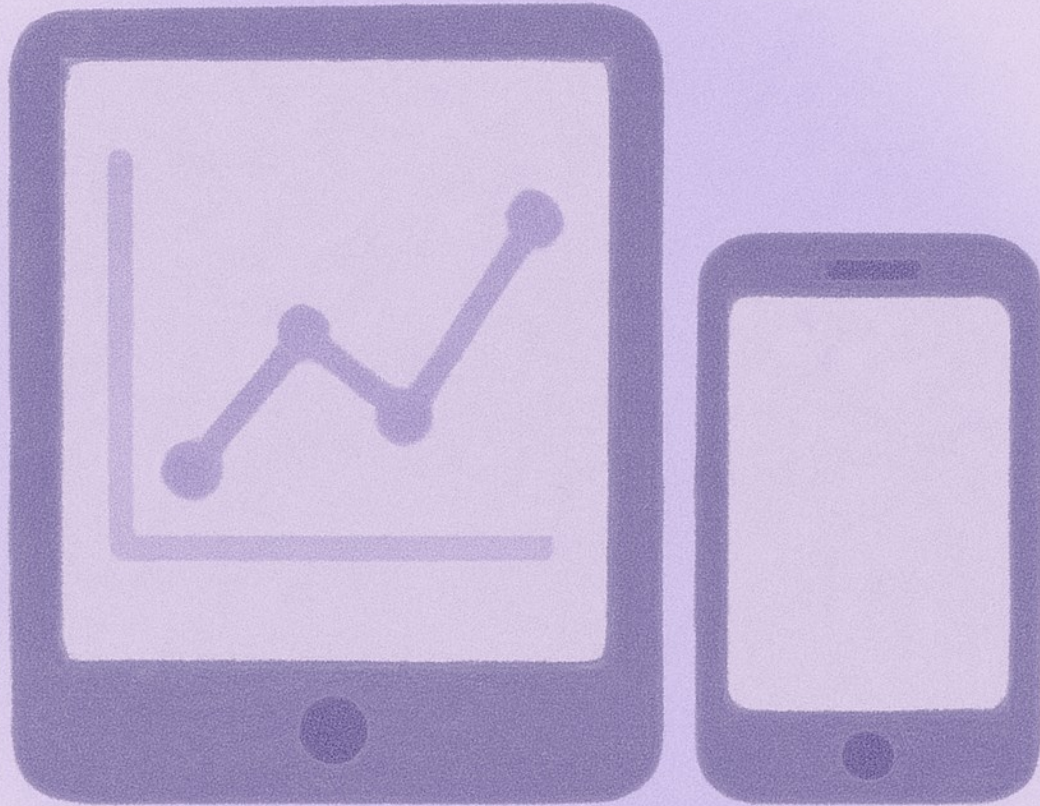
WHAT'S NEXT?

- Descriptive analyses of other Likert-scale questions
- Group analyses of those questions
- Factor analyses of those questions
- Analyses of open questions regarding barriers and usage
-

In my physics classes students sometimes work ...

- with school tablets (8)
- with their own devices (204)
- with both (102)
- with neither option (23)





THANK YOU!

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