Preferences of citizens in Peru for school opening during a public-health crisis: A participatory value evaluation study

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A R T I C L E   I N F O

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A B S T R A C T

Background: The outbreak of COVID-19 was followed by an unprecedented package of measures to protect public health. Over 150 countries mandated school closures to reduce the risk of transmission. Decisions on whether to close schools involve trade-offs between important effects on public health, learning outcomes, well-being of children, productivity of parents.

Objectives: Investigate Peruvian citizens' preferences for schools opening during a public-health crisis such as the COVID-19 pandemic in two scenarios: (i) when the threat from COVID-19 is low and **schools are open**; and, (ii) when the threat from COVID-19 is high and **schools are closed**.

Methods: We conducted a Participatory Value Evaluation (PVE) from 22 September to 17 October 2022, on which 2007 respondents assessed which policy measures to implement in the two scenarios. (i) In **Scenario 1** "Schools are open", children go to school, teachers and parents go to their jobs, but children still experience learning deficits from previous school closures. (ii) In **Scenario 2** "Schools are closed", children cannot go to school and do not receive any formal teaching, leading to learning losses; many teachers must change careers; and, many parents have to stay at home to take care of their children and lose income. Respondents were shown a range of policy measures in each of the scenarios and received information about the effects of each measure on public health, children's well-being and learning loss.

Results: We found that most respondents in Scenario 1 preferred mandatory vaccination for teachers and quarantine measures. In Scenario 2 we found that most respondents were positive towards reopening school policies. In both Scenarios respondents prioritized mandatory vaccination and quarantine measures over other mitigation measures. In Scenario 2, most respondents from the Highland region selected opening schools with 100% on-location teaching while hybrid teaching was mostly selected in the Coast region. Most respondents (82%) evaluated PVE as a good method to involve citizens in policy decision-making.

Conclusions: Policies that focus on prevention (e.g. mandatory vaccination for teachers and quarantine measures) can count on substantial support in a scenario when schools are open. The strong preference for opening schools with a noticeable difference in the way classes are provided (e.g. teaching on location most preferred by respondents from the Highlands and hybrid teaching by respondents from the Coast) show the importance of introducing differentiated strategies among regions.

1. Introduction

The outbreak of COVID-19 was followed by an unprecedented package of measures to protect public health. Over 150 countries mandated school closures to reduce social contacts and the risk of transmission. In Latin America and the Caribbean, about 60% of

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children missed an entire school year due to COVID-19 lockdowns (UNICEF, 2021). Children in Peru were among the most affected due to a two-year school closure, which led to significant learning and well-being losses (UNICEF, 2022).

Decisions on whether to close schools and the introduction of mitigation measures at schools involve difficult trade-offs between important effects on public health and students' learning outcomes (Hammerstein et al., 2021; Kuhfeld et al., 2020), children's well-being in the short and long term, parents' economic activities and working patterns (Del Boca et al., 2020; Sevilla and Smith, 2020), as well as teachers' productivity and employment (Ozamiz-Etxebarria et al., 2021; Palau et al., 2021).

For policymakers facing such decisions, it is relevant to know the preferences of citizens for such trade-offs (Reed et al., 2020). This particularly holds true for a country like Peru, which became the country with the highest mortality rate from COVID-19 globally by the end of 2020 (89.4 deaths per 100,000 inhabitants), had the long duration - two years - of school closure, and where citizen trust in government is low (Ramos et al., 2022; UNICEF, 2022). Similarly, implementing measures of this nature can be more successful if they are accepted by the population and policymakers can count on the approval of a large majority of citizens (Mühlbacher et al., 2022).

Studies assessing preferences for school-opening policies and mitigation measures have been conducted in different settings. For instance, a study in the United States revealed that students and parents support preventive measures such as wearing face masks and temperature checks when teaching is on-location (Hernandez et al., 2020). Furthermore, a discrete choice experiment (DCE) on exit strategies from COVID-19 in Germany showed that respondents with school children tend to be indifferent towards early or late re-opening of schools, while persons without school children have a clear preference for postponing school re-opening (Krauth et al., 2021). Moreover, Dee et al. (2021) found that a significant number of parents of younger children preferred their children not to participate in remote instruction versus in-person instruction. According to a study about the perceptions and expectations during different stages of the COVID-19 pandemic (Beck et al., 2024), it was found that Colombians were less sceptical about the effectiveness of measures (e.g. wearing face masks) and 86% of its citizens avoided social contacts more than respondents from Australia and South Africa. Similarly, a study by Barnachea et al. (2022) in the Philippines found that a sizeable proportion of students preferred hybrid instruction while a small number preferred to proceed with online teaching. In addition, people from lower-income households in the US, mainly communities disproportionately impacted by the virus, were less likely to support reopening schools for on-location teaching (Collins, 2022). Still, evidence about public preferences for school opening in the context of a public-health crisis is limited, especially from countries heavily burdened by the pandemic like Peru.

Policy decisions about opening schools involve a combination of measures, both regarding whether and how to open schools (e.g. hybrid, on-location) and complementary measures to mitigate virus transmission (e.g. wearing masks, mandatory vaccination). To investigate public preferences for possible combinations of these measures, a preference elicitation method is needed that allows participants to make trade-offs between a set of policy measures and their effects. In this study, we use Participatory Value Evaluation (PVE), a fairly novel preference elicitation method that puts citizens in the position of a policymaker and asks them to select the measures they prefer from a set of policy options considering their impacts. PVE facilitates citizens to advise on government decisions in an easy-to-access manner (Mouter et al., 2021b) and has so far been applied to explore preferences for COVID-19 policies (Mouter et al., 2021a, 2022b) and health policies (Mulderij et al., 2021; Rotteveel et al., 2022).

In a PVE, respondents are presented with a single-choice scenario that incorporates all choice alternatives and their impacts, which is different from other common preference elicitation methods like

contingent valuation (CV), DCE or best-worst scaling (Boxebeld et al., 2024). One of the main distinctions is that in a DCE respondents express their preferences by selecting a single policy option in multiple-choice sets while participants in a PVE select a bundle of policy options in a single-choice set (Mouter et al., 2021a).

In this PVE study, respondents were asked to consider different school-opening policies and measures to mitigate transmission of the COVID-19 virus against effects on public health and learning and well-being outcomes for children. Hence, the primary aim of our study is to provide an empirical contribution by identifying the preferences of (different segments of) citizens in Peru for school opening measures during a public-health crisis and impacts of these measures. In addition through conducting PVE in a developing country (Peru) for the first time, we made a methodological contribution by analysing how citizens in a developing country experience expressing their preferences via this method and compared these experiences with the applications in western countries.

2. Methodology

2.1. Selection of scenarios

Preferences for school opening might differ between a scenario in which *schools are open*, versus a scenario in which *schools are closed*. While in the first scenario preferences might be more influenced by concerns about the spread of the virus and potential health impacts, including for teachers, in the latter people might be more concerned about the learning outcomes and children's well-being, the childcare responsibilities and productivity of parents and the labour-market situation of teachers.

Hence, after consultation of the literature about school-opening policies (Dreesen et al., 2020; Engzell et al., 2021; Lennox et al., 2021) and several interviews with policymakers in the fields of education and healthcare in Peru, we decided to present **two scenarios** to the participants in the PVE: **(i)** a scenario in which the threat from COVID-19 is low and *schools are open*; and, **(ii)** a scenario in which the threat from COVID-19 is high and *schools are closed*. The Peruvian policy makers that we interviewed argued that a scenario in which the schools are open is relevant to them as this reflected the state-of-affairs at the time that we conducted our study. Schools were opened after two full years of school closure and policy makers were in need of public input about which policy measures they should implement. In addition, policymakers were still very aware of the recent past with high transmission rates of COVID-19 and its devastating effect on public health and, therefore, wanted to be prepared for a possible future wave of COVID-19 and perhaps having to close schools again. During the period of conducting this study there were still debates over which measures to implement given COVID-19 cases were increasing and Peru was entering into a 4th wave of the pandemic.

Each of the two scenarios in the PVE were presented to respondents and for both scenarios they provided advice. Below, we provide the description of these scenarios and in the order, they were shown:

Scenario 1. *"Schools are open"*: The threat from COVID-19 is **low** and **schools are open**. Children go to school and teachers and parents go to their jobs, but children still experience learning deficits from previous school closures.

Scenario 2. *"Schools are closed"*: The threat from COVID-19 is **high** and **schools are closed**. Children cannot go to school and do not receive any formal teaching, leading to learning losses; many teachers must change their careers to generate alternative income for their families; and, many parents have to stay at home to take care of their children and lose income.
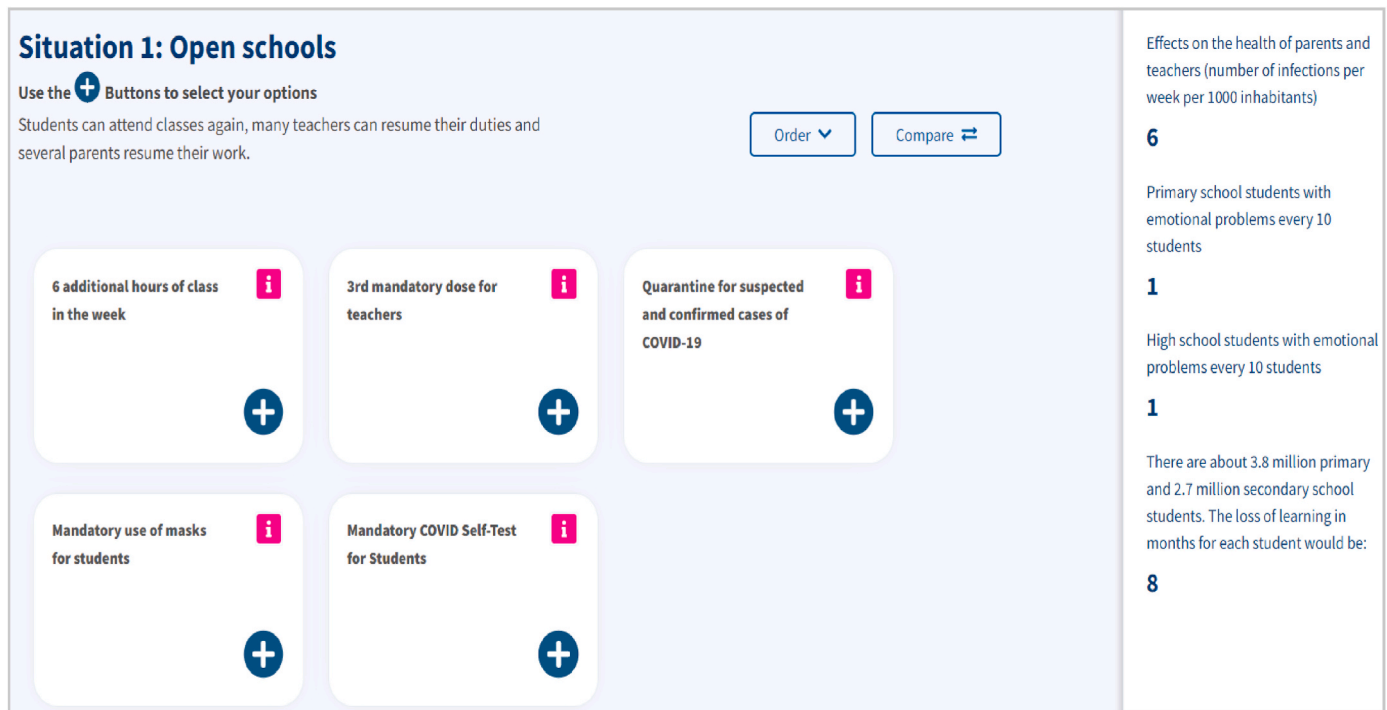
Situation 1: Open schools

Use the ⊕ Buttons to select your options

Students can attend classes again, many teachers can resume their duties and several parents resume their work.

[Order ⌄] [Compare ⇄]

6 additional hours of class in the week ℹ ⊕	3rd mandatory dose for teachers ℹ ⊕	Quarantine for suspected and confirmed cases of COVID-19 ℹ ⊕
Mandatory use of masks for students ℹ ⊕	Mandatory COVID Self-Test for Students ℹ ⊕	

Effects on the health of parents and teachers (number of infections per week per 1000 inhabitants)

6

Primary school students with emotional problems every 10 students

1

High school students with emotional problems every 10 students

1

There are about 3.8 million primary and 2.7 million secondary school students. The loss of learning in months for each student would be:

8

Figure A. Illustration of the choice task screen for scenario 1.

2.2. Selection of policy measures and attribute levels

The essence of the choice task in this PVE is that respondents could select one or more policy measures (i.e. school-opening policies and/or mitigation measures) while being shown with the effects (hereafter called *attributes*) of the policy measure(s) they selected. As we varied information about the impacts of policy measures across respondents, the trade-offs they make when selecting their preferred set of policy measures can be used to infer individuals' preferences for (the attributes of) the policy measure(s) and to rank them in terms of their desirability (Mouter et al., 2021a). For instance, it can allow to estimate whether reducing learning losses of students by X months is equivalent to reducing by Y the number of students with emotional problems when respondents select a certain policy measure.

The policy measures and attributes were selected and defined after review of the related literature (Clarke, 2020; European Centre for Disease Control, 2021; World Bank, 2021; World Bank Group, 2021) and discussions between the research team and civil servants from the Peruvian National Institute of Health, the Peruvian Ministry of Education and experts from UNICEF in June and July 2022. These discussions allowed us to narrow down the design of the PVE to the policy measures most relevant for the Peruvian context. Appendix A in Supplementary Material (Suppl. A) shows the policy measures that each scenario encompassed. In scenario 1 the baseline is that schools are open. In this context, respondents could recommend measures such as 'students having additional hours of classes' and/or 'mitigation measures'. In scenario 2 the baseline is the scenario where schools are closed. In scenario 2 two measures are mutually exclusive implying that respondents could either select the policy measure 'opening schools at 100% capacity' or the policy measure 'hybrid opening'. The rationale of the selection of the policy measures selected are explained in Suppl. B.

Each policy alternative in the choice scenario is defined by its impact on the attributes. The attributes selected for this study were prioritized along with policy makers in the Peruvian health and education sector given the most sensitive and relevant dimensions for the target population (i.e. students) and scope of the study (i.e. school opening). Reports and studies were collected to provide estimates of the attributes. For

instance, to measure health effects we used estimations on how the opening of schools was associated with the spread of COVID-19 in the US (Chernozhukov et al., 2021) and discussed with Peruvian health-policy experts to adjust it to the national context. Similarly, for children's well-being effects we used information on mental health of the age groups 6–10 years and 11–17 years resulting from the COVID-19 crisis in Peru (Caballero and Cutipé, 2021), and for children's learning loss we considered results with simulations of school closure impact on loss of years of schooling adjusted for quality (Azevedo et al., 2020). We integrated this information and the feedback of policymakers into the PVE design (see Suppl. C).

2.3. Questionnaire structure

The questionnaire of the study was structured as follows and it can be found online via PVE_Peru.

The questionnaire consisted out of 4 parts:

- **Part 1.** Animation video that served as an introduction to the topic
- **Part 2.** This part was divided in choice tasks for scenarios 1 and 2:
  - **Choice task in Scenario 1:** An instructive video describing and explaining the task for the first Scenario "Schools are open" was shown to respondents; respondents were explained that in this scenario the schools are open, and they are asked which policies they would advise in this context. Respondents could make their selections among a set of policy measures or select none of the measures. After respondents recommended policy measures, they were asked to write their motivations for the selection(s) they made.
  - **Choice task in Scenario 2:** For this second scenario "Schools are closed" the structure was similar as for scenario 1.
- **Part 3.** Respondents were asked whether they agreed with various statements related to how they experienced the study.
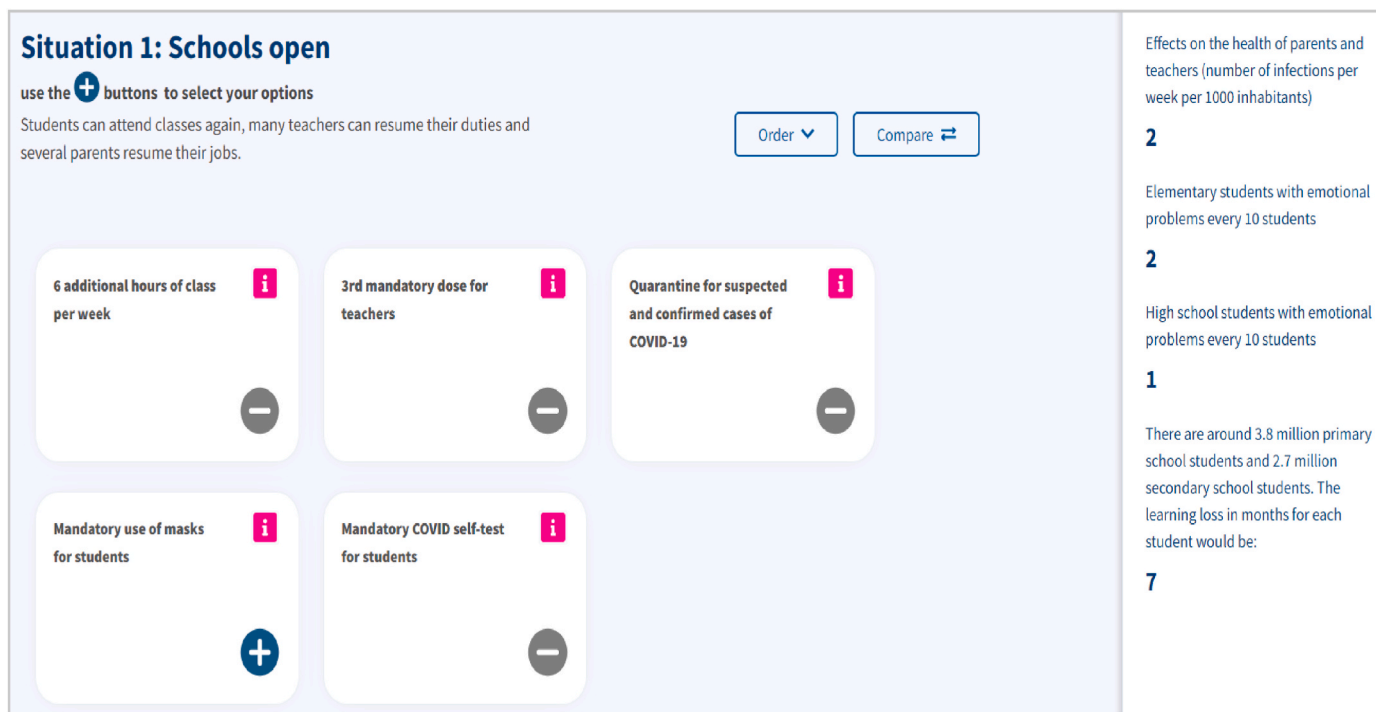- **Part 4.** Questions about socio-demographic characteristics.

Figure B. Illustration of the choice task screen when a number of measures were selected in scenario 1.

2.4. Pilot study

This experiment was tested in an initial pilot sample of 100 respondents. The most important finding from this pilot study was that the instructions for the choice task were insufficiently clear: Some respondents did not understand the task correctly and thought they either had to rank the measures or had to choose the measures they did not support. We incorporated all the respondents' feedback into the final version of the PVE. To clarify the choice task, an instructive video was developed and shown to respondents in the main study before the start of the PVE.

2.5. Choice task

In each scenario, before starting with the choice task, respondents watched the instruction video which explained the task (e.g. how to find more information concerning a policy measure; how to select a policy measure if they wanted to recommend any; and, how the effects of policy measures on public health, children's well-being and learning outcomes were displayed). Then, respondents were asked which policy measures they would recommend that the government should implement considering their effects on public health and children's well-being and learning outcomes.

Figure A shows how the PVE choice task for *Scenario 1* was presented to respondents. On the right side of the screen, the effects on the health of teachers and parents, children's well-being (primary and secondary school students, respectively) and learning outcomes were shown. The baseline levels of the attributes (i.e., in the initial situation when no policy measures are selected) were 'six infection cases per week per 1000 inhabitants', 'one student from primary school' and 'one student from secondary school' with emotional problems every 10 students and 'eight months of learning loss for students'.

Figure B shows an example when a respondent selected four of the five measures, leading to a change in the attribute levels on the right side of the screen (e.g. a reduction in the number of COVID-19 infections given the healthcare mitigation measures selected, and a reduction in the number of months of learning loss from 8 to 7).

Table 1
Socio-demographic characteristics of respondents.

Variable		Sample (N = 2007)	Census
Age	18–35	43.6%	41%
	36–55	45.4%	45%
	56–65	11%	14%
Gender	Female	48%	50.4%
	Male	51.9%	49.6%
Education level	Up to Secondary School	7%	70%
	Superior (University and non-university)	93%	30%
Region of residence	Coast	82.6%	58%
	Highlands	14.3%	28%
	Amazon	3.1%	14%
Children Marital Status	(%) Yes	52.5%	
	Married	28.9%	34.7%
	Cohabiting	14.4%	32.3%
	Divorced	4.1%	1.5%
	Separated	2.9%	7.4%
	Single	49.1%	16%
	Widow	0.6%	8%
Employment Status	Housewife	4.2%	
	Employed	53.4%	72.4%
	Unemployed	6.8%	6.1%
	Independent work	29.2%	
	Other	6.4%	
Making ends meet	With great difficulty	19.9%	
	With some difficulty	55.9%	
	Fairly easily	14.8%	
	Easily	9.4%	
Vaccination Status	Not vaccinated	1.9%	
	1–2 doses	5.1%	
	3–4 doses	93%	
Health Status	Rating of own health state	14.9 (mean)	
		Min 0 – Max 20	
Well-being Status	Rating of own well-being state (happiness)	13.9 (mean)	
		Min 0 – Max 20	

Reopening schools either at full (100%) capacity or hybrid, both in-person learning, could bring a number of public-health risks, thus this needs to be contingent on implementing a set of mitigation strategies

that limit virus transmission (National Academies of Sciences, Engineering, and Medicine, 2020). Therefore, the approach for **Scenario 2** is that respondents could choose mitigation measures only if they selected at least one of the school reopening measures, as the baseline in this scenario was that schools are closed. In addition, given that opening schools at 100% capacity or hybrid are mutually exclusive measures, respondents could choose either to fully open schools or hybrid teaching for primary and secondary school separately. Illustrations of the choice task screens for Scenario 2 are presented in Figures D1 and D2 of Suppl. D.

2.6. Data collection

The respondents were sampled from the online panel of Dynata, with a view to be representative in age (18–65 years) and sex of the Peruvian population. The Research Ethics Review Committee of the Erasmus School of Health Policy & Management approved the study protocol (case number ETH2122-0778). Participation was voluntary and could be terminated at any point, and informed consent for participation and use of their responses was given by all respondents. The national consultation ran from 22 September to 17 October 2022 and a total of 2007 respondents completed the questionnaire. At the time that we were conducting our study there were between 60 and 477 citizens hospitalized per week in Peru (Peruvian Ministry of Health, 2022). Table 1 provides an overview of the socio-economic and demographic characteristics of the sample. The full list of questions can be found in Suppl. H.

2.7. Descriptive statistics

In both scenarios, we assessed the preferences of the general public (i.e., whole sample) and the sub-sample of teachers. We specifically analysed teachers' preferences given their role as learning facilitators and the potential implications that certain policy measures in both scenarios might have on them (e.g., Mandatory third vaccine dose for teachers).

2.8. Statistical analysis

We conducted two types of statistical analysis, namely a portfolio choice model aimed at identifying the policy measure(s) with the highest societal value and a latent class cluster analysis to identify segments of the population with different preferences. The following subsections provide a brief description of each method.

2.8.1. Portfolio choice model

Firstly, we analysed the data using a portfolio choice model. This model for PVE experiments is proposed by Bahamonde-Birke and Mouter (2019) and based on the Random Utility Maximisation (RUM) model of discrete choice modelling (McFadden, 1974). In a portfolio choice model, we assume that respondents seek to maximise their utility from their selected combination of policy measures and their costs and effects (Mouter et al., 2022a). The specific portfolio choice model used is a variation of the work of Bahamonde-Birke and Mouter (2019) since it considers preferences for policy measures and their effects, but not for costs. We selected the portfolio choice model because of its flexibility to model PVE choice situations with mutually exclusive and conditional policy measures as used in Scenario 2 (see Suppl. E for a detailed description on this method).

The estimates of the portfolio choice model concern "taste parameters" representing the importance that individuals give to each effect on their choice of measures (i.e. it indicates whether an increase in the associated effect makes a measure more (un)attractive) and so-called "measure-specific" constants to determine the benefits and costs individuals obtain from specific measures, irrespective of the effects explicitly provided in the experiment. A higher and positive value on the estimates for measure-specific constants reflects a stronger preference

Table 2
Model fit results of LCCA model for Scenario 1 and 2.

Sample (N = 1930)		Scenario 1. Schools are open		Scenario 2. Schools are closed		
No. of classes	Npar	LL	BIC(LL)	Npar	LL	BIC(LL)
1	5	−6520.15	13,078.13	8	−9072.80	18,206.11
2	11	−6246.67	12,576.56	17	−8103.89	16,336.38
3	17	−6201.82	12,532.24	26	−7674.31	15,545.32
4	23	−6173.6	**12,521.21**	35	−7539.32	15,343.42
5	29	−6162,67	12,544.73	44	−7448.35	**15,229.58**
6	35	−6158.54	12,581.87	53	−7423.22	15,247.40
7	41	−6156.15	12,622.47	62	−7407.01	15,283.07
8	47	−6156.33	12,668.24	71	−7400.92	15,338.98

Npar Number of parameters.
LL Log-Likelihood.
BIC(LL) Bayesian Information Criterion (based on Log-Likelihood).

for the associated measure(s).

The estimated parameters are also used to reconstruct the utility function for different combinations of measures and determine the combination that maximises the expected utility of respondents, known as the "optimal portfolio". This process is based on simulation of the expected utilities of each combination of measures, given a set of estimated parameters, and the optimal portfolio is identified by sorting the expected utility of each feasible combination of measures (See Suppl. F).

2.8.2. Latent class cluster analysis

We analysed the respondent's choices using Latent Class Cluster Analyses (LCCA) to identify patterns in the measures selected. For each scenario, the measures were included as (nominal) indicators of the latent classes. Based on maximum likelihood estimation, the goal of LCCA is to maximise the homogeneity within clusters and the heterogeneity between clusters (Sasidharan et al., 2015). This allowed us to identify clusters of people with related patterns of support for the various measures and distinguish them from those with maximally different patterns.

A benefit of LCCA is that covariates can be included in the model to assess their associations with class membership. In doing so, the analysis can reveal which segments of the population (e.g. in terms of age, gender, region of residence) are relatively frequently in a certain cluster. This makes it possible to determine which (combinations of) measures receive most support among certain groups of respondents (Mouter et al., 2022b). This analysis can thus be used to identify similarities and differences between population subgroups in preferences for school reopening and mitigation measures, and to provide insights on the strategies best aligned with the preferences of particular population subgroups.

The objective of the LCCA is to find the most parsimonious model (i. e. with the smallest number of latent classes) that (still) adequately describes the associations between the indicators (Molin et al., 2016). To identify the optimal number of latent classes for each scenario, subsequent models were estimated with 1–8 latent classes using Latent Gold (Vermunt and Magidson, 2016). Based on the Bayesian information criterion value, which has been shown to perform well in the context of latent class analysis (Nylund et al., 2007), the optimal model for scenarios 1 and 2 were *4 and 5 classes*, respectively (see Table 2).

We conducted the LCCA using Latent GOLD 5.1 (Vermunt and Magidson, 2016). After establishing the optimal number of latent classes for scenarios 1 and 2, the covariates were added to the models. The following covariates were considered in the analyses: sex, age, level of education, whether the respondent lives with an elderly person (65+) in the household, income (in terms of perceived ease/difficulty to make ends meet), financial issues experienced due to the COVID-19 pandemic, impact on health, region of residence, whether the participant or
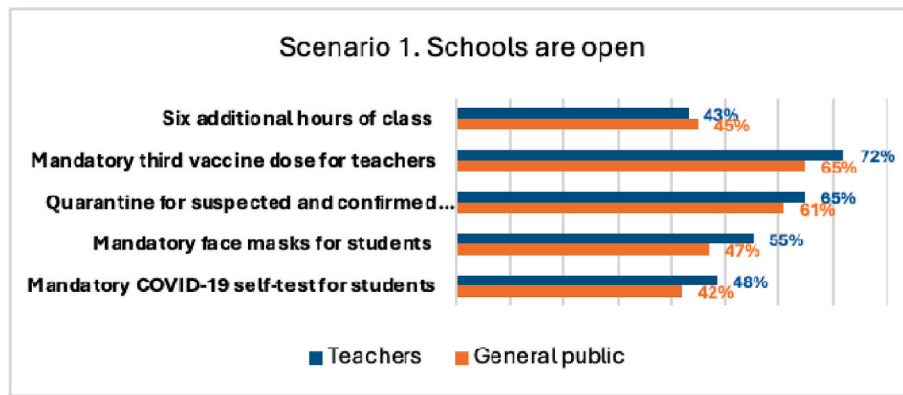
Figure C. Share of the General public and teachers who chose a certain measure in Scenario 1.
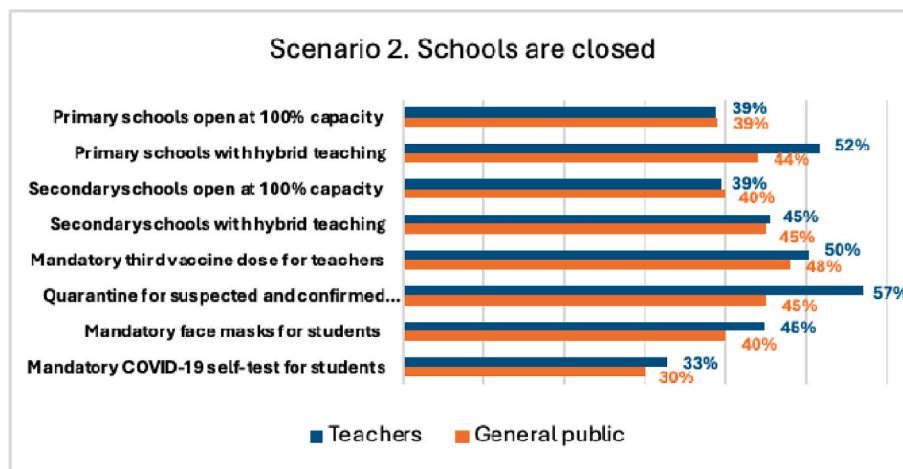

Figure D. Share of the General public and teachers who chose a certain measure in Scenario 2.

someone in his/her family is a teacher, number of COVID-19 vaccines taken, and whether the participant has children. Significance on the relationship between covariates and the classes were computed with the Wald test. Only statistically significant (p < 0.05) covariates were retained, as shown in the results of the LCCA for each scenario in Tables 5 and 8. In this regard, these results can be interpreted as the within-cluster distributions of the indicators (i.e., the policy measures) and covariates (e.g., measures that are selected by respondents according to the characteristics included in the model).

3. Results

In section 3.1 we present descriptive statistics regarding the policy measures chosen by respondents in scenarios 1 ("schools are open") and 2 ("schools are closed"). In section 3.2 we present respondents' preferences for these measures by estimating a choice model and computing the optimal portfolio per scenario and how these preferences differ among subgroups using a Latent Class Cluster Analysis.

3.1. Descriptive statistics

Firstly, Figures C and D report what percentage of the respondents (i. e. general public) and teachers opted for certain measures in scenarios 1 and 2 respectively. Given that our sample has a significant population of teachers (195) and their role in schooling provision and the importance to know their preferences, we also highlight their selections for the policy measures across scenarios.

As shown in Figure C, in Scenario 1, the acceptance of measures concerning a ***Mandatory third vaccine dose for teachers*** and ***quarantine for suspected and confirmed cases*** was higher than 60%, while each of the other measures were supported by less than 50% of the general public. On the other hand, as shown in Figure D, in Scenario 2, all the measures were considered acceptable by less than 50% of the general

Table 3
Estimation results of the portfolio choice model, Scenario 1.

	Estimate	Std. Err	P-Value
Measure-specific constants			
Six additional hours of class	−0.350	0.131	0.008
Mandatory third vaccine dose for teachers	0.590	0.050	0.000
Quarantine for suspected and confirmed COVID-19 cases	0.509	0.060	0.000
Mandatory use of face masks for students	−0.093	0.054	0.088
Mandatory COVID-19 self-test for students	−0.263	0.065	0.000
Taste parameters			
COVID-19 weekly infections	0.010	0.027	0.705
Primary school students with emotional problems (every 10 students)	−0.074	0.042	0.078
Secondary school students with emotional problems (every 10 students)	−0.066	0.044	0.140
Learning loss for children (number of months)	−0.106	0.079	0.181
Estimation output			
Number of observations	1930		
Log-likelihood	−6516.23		
Akaike Information Criterion (AIC)	13,050.45		
Bayesian Information Criterion (BIC)	13,100.54		

Table 4
Portfolios with the highest expected utility, Scenario 1.

Measures	Ranking (The "✔" sign means that the measure is part of portfolio)									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Six additional hours of class		x	✔	✔				✔		
Mandatory third vaccine dose for teachers	✔	✔	✔	✔	✔	✔	✔	✔	✔	
Quarantine for suspected and confirmed COVID-19 cases	✔	✔	✔	✔	✔		✔	✔		✔
Mandatory usage of face masks for students		✔		✔			✔		✔	
Mandatory COVID-19 self-test for students					✔		✔	✔		

Table 5
Results of the LCCA, Scenario 1.

Cluster Size	Some health measures	No measures	All health measures	All measures
	45%	24%	22%	8%
Indicators				
Six additional hours of class	50%	43%	21%	96%
Mandatory third vaccine dose for teachers	89%	3%	70%	100%
Quarantine for suspected and confirmed COVID-19 cases	70%	22%	70%	100%
Mandatory usage of face masks for students	47%	14%	62%	100%
Mandatory COVID-19 self-test for students	28%	16%	78%	100%
Characteristics of cluster members				
Age				
18–35 years	45%	34%	60%	34%
36–55 years	43%	54%	36%	50%
56–65 years	12%	13%	4%	15%
Pandemic affected income				
The pandemic affected my income (0 = extremely negatively; 1 = extremely positively)	0.35	0.40	0.42	0.42
Teacher in the family				
I am not a teacher nor are any members of my family	54%	62%	45%	57%
I am not a teacher but someone in my family is	38%	33%	42%	30%
I am a teacher	8%	5%	12%	12%
Have children				
Children (Yes)	56%	60%	36%	67%
Number of COVID-19 vaccine doses				
0	0%	5%	1%	2%
1–2	3%	10%	3%	3%
3	60%	55%	69%	56%
4	37%	29%	27%	39%

public. Nonetheless, within this set of measures, a mandatory third vaccine dose for teachers as well as quarantine remained the highest preferred (the most popular measures in Scenario 1).

Healthcare-mitigation measures that apply to students (i.e., mandatory use of face masks and COVID-19 self-testing) were chosen less often by members of the public than those that apply to teachers. In addition, respondents preferred hybrid teaching over opening schools at 100% capacity, both for primary and secondary education.

As shown in Figure C, similar to the acceptance pattern among policy measures in Scenario 1 by the general public, most teachers (72%) supported a ***Mandatory third vaccine dose for teachers***, followed by a 65% who were in favour of ***quarantine for suspected and confirmed cases.*** Similarly, in Figure D the acceptance of teachers for mitigation

measures in Scenario 2 was also higher for these two measures with 57% and 50%, respectively. Moreover, like the general public, teachers preferred hybrid teaching over opening schools at 100% capacity, both for primary and secondary education.

3.2. Results of choice models and latent class cluster analyses

3.2.1. Scenario 1

The results of the portfolio choice model for Scenario 1 (Table 3) show that almost all estimated parameters were statistically significant at 95% of confidence level, except for 'mandatory face masks for students', which was statistically significant at 90% of confidence level. It was observed a stronger positive preference for 'Mandatory third vaccine dose for teachers' and 'Quarantine for suspected and confirmed COVID-19 cases'. The parameters of all the other measures (i.e., Mandatory use of face masks for students and Mandatory COVID-19 self-test for students) were negative which means that respondents inherently disliked these measures. When analysing the taste parameters, we observed that only the estimate for *Primary school students with emotional problems* was statistically significant at 90% of confidence level.

The taste parameter that corresponds to *Primary school students with emotional problems* had a negative sign (−0.074). Hence, an increment of *Primary school students with emotional problems* was not preferred by respondents. This negative sign implies that implementation of COVID-19 measures may become unattractive if they affect students' mental health. For example, considering the estimated parameter of 'quarantine for suspected and confirmed cases' (0.509), we can infer that if seven or more primary school students develop emotional problems as a result of implementing this measure, then the utility for that policy measure becomes negative (i.e., 0.509–7 * −0,074 < 0). On the other hand, it can be inferred that if the number of *Primary school students with emotional problems* could be reduced to five out of 10; and four out of 10, then 'six additional hours of class' and 'mandatory COVID-19 self-test for students' become positive.

Observing the 10 portfolios with the highest expected utility (Table 4), it was inferred that the most preferred set of measures consists of 'Mandatory third vaccine dose for teachers' and 'Quarantine for suspected and confirmed COVID-19 cases', which were the most dominant measures since they were always part of the five highest-ranked portfolios. In contrast, measures less often preferred (which are inherently disliked by respondents) were: 'Six additional hours of class', 'Mandatory COVID-19 self-test for students' and 'Mandatory use of face masks'.

Table 5 summarises the estimation results of the LCCA for scenario 1. In the largest Cluster 1 'some measures' (45% of the sample), a high percentage of respondents selected a Mandatory third vaccine dose for teachers and quarantine for suspected and confirmed cases. Cluster 2 'no measures' (24%), which was mainly represented by middle-aged respondents (36–55) and showed the highest ratio of unvaccinated, did not support all the measures. In Cluster 3 'health measures' (22%) respondents advised the four mitigation measures except the measure incorporating six additional hours of classes per week for students. Respondents in this cluster more often were in the youngest cohort, had no children and had someone in the family who is a teacher.

All but a few respondents in Cluster 4 'all measures' (8%) advised all

Table 6
Estimation results of the portfolio choice model, Scenario 2.

	Estimate	Std. Err	P-Value
Measure-specific constants			
Primary Schools Open at 100% capacity	0.707	0.222	0.001
Hybrid classes are provided in Primary Schools	0.819	0.111	0.000
Secondary Schools Open at 100% capacity	0.912	0.222	0.000
Hybrid classes are provided in Secondary Schools	0.966	0.125	0.000
Mandatory third vaccine dose for teachers	−0.078	0.049	0.114
Quarantine for suspected and confirmed COVID-19 cases	−0.198	0.058	0.001
Mandatory usage of face masks for students	−0.400	0.055	0.000
Mandatory COVID-19 self-test for students	−0.867	0.064	0.000
Taste parameters			
COVID-19 weekly infections	−0.011	0.024	0.648
Primary school students with emotional problems (every 10 students)	−0.016	0.041	0.706
Secondary school students with emotional problems (every 10 students)	0.054	0.045	0.228
Learning loss for children (number of months)	0.002	0.021	0.906
Estimation output			
Number of observations	1930		
Log-likelihood	−9022.67		
Akaike Information Criterion (AIC)	18,069.35		
Bayesian Information Criterion (BIC)	18,136.13		

the measures, which was the only cluster in which including six additional hours of teaching was advised by the majority. This cluster was mainly represented by respondents who had received four doses of the COVID-19 vaccine and have children. Moreover, it is shown in the four clusters that the pandemic affected respondents' income negatively with a small difference among them. Finally, it is observed that clusters 1, 3 and 4 were aligned with the results in the optimal portfolio, being 'Mandatory third vaccine dose for teachers' and 'quarantine' most preferred.

3.2.2. Scenario 2

As shown in Table 6, all estimated parameters for school reopening measures were statistically significant at 95% of confidence level positive and higher than those corresponding to mitigation measures (all of them negative), from which only 'Mandatory third vaccine dose for teachers' was non-significant. Indeed, a higher value of these estimates reflects a stronger preference for the associated measure irrespective of its effects, which in this scenario could also be attributed to the fact that mitigation measures were possible to select only if a school measure was first selected. In addition, it can be observed that there was a stronger preference for hybrid classes either in primary or secondary schools versus opening them at 100% capacity. Conversely, all taste parameter estimates were not statistically significant.

Based on the 10 best portfolios in terms of their expected utility (Table 7), it can be inferred that the most preferred set of measures consisted of reopening primary and secondary schools in hybrid mode. The second most preferred was composed by the same measures including a mandatory third COVID-19 vaccine dose for teachers, being

the last measure most frequently found in the set of optimal portfolios in comparison to the other three mitigation measures. Subsequent sets in the ranking showed combinations between reopening schools - in person and hybrid. 'Quarantine for suspected and confirmed COVID-19 cases' as part of the portfolio ranked fifth. On the other hand, along this 10-level ranking measures such as mandatory face mask and COVID-19 self-test for students were not part of the set, and therefore not preferred by respondents, which is consistent with the high negative values of their respective estimates.

Table 8 presents the estimation results of the LCCA for Scenario 2. In the largest cluster 1 'Hybrid with all measures' (28% of the sample), respondents supported all measures. In this cluster, respondents slightly more often were in the youngest age category, had no children and were from the Coastal region, and less often were from the Amazon region. The majority of respondents of Cluster 2 'Open primary and secondary schools at 100% capacity with some measures' (26%) advised all the measures, except the obligation for students to do the COVID-19 self-test. Respondents in this cluster more often were vaccinated and experienced no change to their employment status.

Respondents of Cluster 3 'Hybrid with no measures' (20%) were positive towards opening schools in a hybrid mode but reject all the mitigation measures. Respondents in this cluster were similar to the overall sample. The majority of respondents in Cluster 4 'Open primary and secondary schools at 100% capacity with no measures' (15%) were in favour of opening schools at 100% capacity but not of the mitigation measures. Respondents in this cluster more often were in the middle age category, had children, lived in the Highlands region and were unvaccinated. Finally, Cluster 5 'Schools closed with no measures' (12%) were not positive about all the measures. In this cluster, respondents more often were from the Coast and less often from the Highlands, and most often reported to being temporary unemployed during the pandemic.

For the first four clusters presented in Table 8, which were in favour of opening schools, there was a stronger preference for opening hybrid or at 100% capacity. This was in line with the preferences measured in the experiment (see Suppl.G).

3.3. Respondents experience with PVE

To assess how respondents experienced the PVE, we asked them to rate five statements (see Figure E). Most respondents (77%) (strongly) agreed that they were confident about their choices in the PVE and 69% that the study provided them with enough information to be able to give advice to the government. A large majority (82 %) (strongly) agreed that PVE is a good method to involve citizens in school reopening and healthcare measures decision-making. Most respondents (77%) (strongly) agreed that their acceptance of these measures would increase if the government involved many citizens via a PVE, while previous studies have reported 62% and 40% respectively (Mouter, et al., 2021a, 2022b). Finally, 81% (strongly) agreed that PVE should be used more often by the Peruvian government.

When respondents were asked whose advice the government should prioritise, 22% indicated the government should value the advice of experts more, which is considerably lower than found in previous PVEs

Table 7
Portfolios with the highest expected utility, Scenario 2.

Measures	Ranking (The "✔" sign means that the measure is part of portfolio)									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Hybrid classes in Primary and Secondary schools	✔	✔			✔				✔	
Primary and Secondary schools open at 100% capacity								✔		
Primary schools open at 100% capacity and Secondary schools Hybrid			✔				✔			
Primary schools Hybrid and Secondary schools open at 100% capacity				✔		✔				✔
Mandatory third vaccine dose for teachers		✔				✔	✔		✔	
Quarantine for suspected and confirmed COVID-19 cases					✔				✔	✔
Mandatory usage of face masks for students										
Mandatory COVID-19 self-test for students										

Table 8
Results of the LCCA, Scenario 2.

	Hybrid with all measures	100% capacity with some measures	Hybrid with no measures	100% capacity with no measures	Schools closed with no measures
Cluster Size Indicators	28%	26%	20%	15%	12%
Primary Schools Open at 100% capacity	4%	84%	8%	98%	2%
Hybrid classes are provided in Primary Schools	91%	11%	77%	0%	9%
Secondary Schools Open at 100% capacity	5%	89%	7%	84%	12%
Hybrid classes are provided in Secondary Schools	91%	8%	82%	0%	12%
Mandatory third vaccine dose for teachers	82%	85%	7%	16%	0%
Quarantine for suspected and confirmed COVID-19 cases	84%	64%	19%	15%	0%
Mandatory usage of face masks for students	77%	60%	11%	8%	0%
Mandatory COVID-19 self-test for students	56%	43%	13%	5%	0%
Characteristics of cluster members					
Age					
18–35	50%	46%	42%	39%	42%
36–55	41%	41%	49%	51%	46%
56–65	9%	13%	9%	10%	12%
Children 6–12 years old					
No	84%	76%	79%	73%	78%
Yes	17%	24%	21%	27%	22%
Region of residence					
Coast	87%	81%	82%	75%	86%
Amazon	1%	4%	3%	5%	4%
Highlands	12%	14%	15%	21%	10%
Employment affected due to pandemic					
Temporarily unemployed	24%	19%	28%	26%	32%
Temporarily unable to work	6%	4%	5%	3%	4%
Loss job	19%	22%	17%	23%	19%
No	52%	55%	50%	49%	45%
Number of COVID-19 doses					
0	1%	0%	1%	7%	3%
1–2	3%	4%	5%	10%	4%
3	62%	58%	64%	53%	66%
4	34%	39%	30%	30%	28%

(e.g. Mouter et al., 2022b; Mouter et al., 2021a), while 7 % indicated that the advice of citizens should receive more value and 58% that equal value should be given to the advice of citizens and experts.

4. Discussion

This study provides an empirical contribution by conducting PVE in a developing country (Peru) for the first time, which allowed to identify the preferences of citizens in Peru for policy measures during a public-health crisis. This study analysed citizens' preferences regarding school opening and mitigation measures in two scenarios: 1) **schools are open;** and, 2) **schools are closed**. In addition, we assessed whether these preferences vary between sample subgroups and how respondents evaluated the method.

4.1. Main conclusions

We found that most respondents in Scenario 1 preferred 'Mandatory third vaccine dose for teachers' and 'Quarantine for suspected and confirmed COVID-19 cases'. In Scenario 2 we found that most respondents were positive towards reopening school policies, primarily hybrid followed by 100% capacity. When comparing the ranking of the policy measures in both scenarios (i.e. optimal portfolios), we observed that 'Mandatory third vaccine dose for teachers' and 'Quarantine for suspected and confirmed COVID-19 cases' are prioritized in both Scenarios over other mitigation measures. Similarly, the youngest age group is more willing to support these measures than older respondents. This is in contrast with a study conducted in Germany, which found that citizens are sceptical about the implementation of more stringent measures and cautious about school reopening strategies (Krauth et al., 2021). Likewise, a study in The Netherlands reported that respondents generally had a negative preference for policies that promote vaccination uptake (Mouter et al., 2022a). Moreover, even though empirical studies on preferences in this regard are scarce in Latin America, measures implemented by some governments in this region considered for example random COVID-19 tests and flu vaccine among teachers, and mandatory face mask in Uruguay (Alarcón and Méndez, 2020); washing hands minimum every 3 h, use of hand sanitizer and use of face masks in Colombia (Ministry of Education, 2020).

In Scenario 2, most respondents selected hybrid opening of primary and secondary schools and were mainly represented by those from the Coast region, while opening schools at 100% capacity (i.e. all classes on location) are preferred by citizens living in the Highlands and Amazon regions. For Scenarios 1 and 2, households with children were more in favour of additional hours of classes and opening at 100% capacity, respectively. This finding is consistent with other studies to the extent that people with young children are more likely not to be in favour of school closure and to prefer their children's education not to be interrupted or not having to pay for childcare (Dong et al., 2020; Ozdemir et al., 2021). Indeed, it can be inferred that citizens are hesitant about the implementation of stringent measures (e.g. keep schools closed), which is aligned with the findings of (Mouter et al., 2022b). In addition, in both Scenarios 1 and 2 clusters where the proportion of unvaccinated respondents is higher are mostly not in favour of all the mitigation measures which is in line with findings in existing literature (e.g. Mouter et al., 2022b). Finally, we observe that the only effect that might have influenced the respondents' measures selection in Scenario 1 is 'the number of students with emotional problems in primary schools' while none of the effects might have driven the preferences by the measures in Scenario 2.

4.2. Strengths and limitations

A primary strength of this study is that participants were positive about expressing their preferences through the PVE method. Peruvian respondents were even more positive about their participation than the participants in PVEs that were applied in western countries. In addition, our study provided a range of relevant empirical results for policy makers. For instance, the LCCA conducted made it possible to identify heterogeneity in the preferences of citizens according to critical
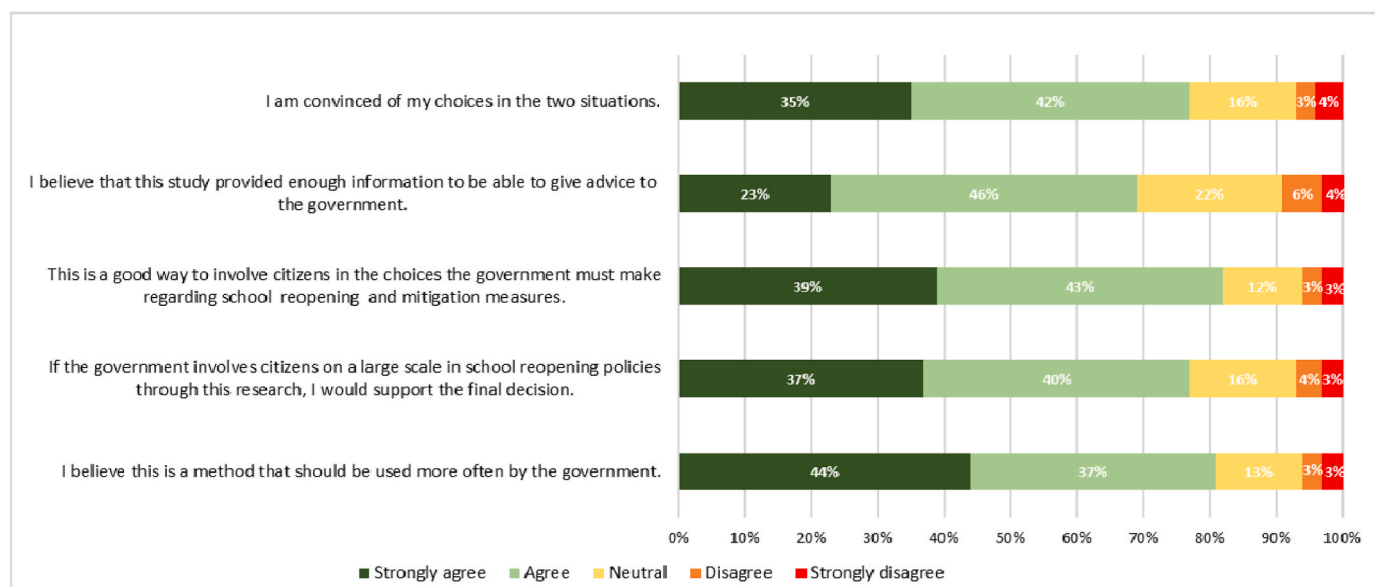
Figure E. Answers to five statements about experiences of the PVE experiment.

variables in this context, such as region of residence, respondents who have run into financial problems due to the pandemic, number of COVID-19 vaccine doses and respondents with children.

On the other hand, our study has some limitations. One of the main limitations concerns that we were not able to measure respondents' sensitivity for the effects of policy measures. We think that the insignificant taste parameters might be caused by the small ranges of the effects of policy measures shown to the respondents (e.g. 1/2/8 COVID-19 weekly infections per 1000 inhabitants). These ranges (variations) might have been too small for respondents to affect their choices. Further research might shed light on the plausibility of this interpretation, such as showing respondents broader bandwidths of the effects (e. g. 10/100/200 COVID-19 weekly infections per 1000 inhabitants) to test if the effect sizes presented are sufficient to affect respondents' decision-making. Another possible reason for the insignificant taste parameters can be that respondents did not take the information on effects into account in their decisions and cared more about the measures *per se.*

Since the PVE was conducted online, it might have resulted in low participation of less-digitally literate people. There was also an over-representation of highly educated respondents living in the Coast region. Nonetheless, in the LCCA we observed that education level was not statistically significant, then this did not lead to different results. Moreover, there was a limitation on the information about actual effects of the policy measures presented to respondents since some of them were adapted using empirical studies from other contexts. In addition, the finding that almost all effects were not statistically significant in explaining respondents' choices for policy options raises questions about whether respondents took account of all the information provided. Previous PVE studies have also found that some respondents struggled with the complexity of the experiment (Mouter, et al., 2021a, 2021b). On the other hand, 77% of the respondents reported that they were convinced of their choices, which can be an indicator that most respondents understood the experiment despite the choice tasks in the PVE being relatively complex. One solution to alleviate the complexity of the choice task is to make more use of audiovisual information instead of text and numerical information.

When observing the measures most selected by teachers, we observe that these preferences are quite aligned with those of the general public (e.g. Mandatory third vaccine dose for teachers in Scenario 1). In this regard, it is also important to note that despite a majority of teachers was in favour of this mitigation measure, there is a subgroup who did not select this measure. Thus, further investigating the willingness of

teachers to vaccinate is recommended. It is not clear to which extent our results can be generalized to other stages in the pandemic. For instance, given the current endemic phase, people's preferences for certain measures might have changed which may be investigated further. Further research may also assess the generalizability of our results in other Latin American countries considering this was the first application in the region. Further research could also consider including assessing effects of these measures on learning loss given the burden that can generate when individuals get sick in a context where an informal economy is prevalent. Similarly, well-being of teachers holds important given the direct implications that these measures might have on them.

4.3. Policy implications

The results, particularly from the 'schools are open' scenario, which is more applicable to the current situation in Peru, suggest that policies that focus on prevention through advising mandatory vaccination for teachers and mandatory quarantine for suspected and actual cases can count on substantial support given the reduction in risk of transmission and interruption of classes for students. On the other hand, there is low support for measures that are more stringent for students such as use of face masks. Furthermore, our results show a strong preference for having schools open with a noticeable difference in the way classes are provided, with teaching on location (i.e. open at 100% capacity) most preferred by respondents from the Highlands and hybrid teaching by respondents from the Coast. This can motivate government to deploy differentiated strategies in the provision of education given the main constraints and characteristics between inhabitants of these regions (e.g. limitations on internet access and connectivity). In addition, since unvaccinated respondents living in the Highlands are relatively hesitant about health measures, targeting communication strategies in this regard towards these groups could be considered.

Furthermore, beyond informing policy makers about citizens' preferences on specific measures, our findings suggest that these preferences are seemingly not guided by (small changes in) effects that might be relevant for the policymaker. If the government communicates about decisions on measures during a pandemic, citizens' preferences might be primarily motivated by the type of measures, while providing them with information on the effects (e.g. reduction of weekly COVID-19 infections) might not lead them to accept a measure that they were not prone to support.

Finally, most respondents perceived PVE as a good method to involve

citizens in decision-making, indicated that using such methods might lead to higher support for final policy decisions and recommended using it more often in Peru in the context of important social matters. Therefore, introducing a tool such as PVE into public consultation processes can contribute to the legitimacy of policy decision-making, also in developing countries.

CRediT authorship contribution statement

Karen Trujillo Jara: Writing – original draft, Project administration, Methodology, Formal analysis, Conceptualization. **Jose Ignacio Hernandez:** Methodology. **Niek Mouter:** Writing – review & editing, Supervision, Methodology, Formal analysis. **Werner Brouwer:** Supervision. **Job van Exel:** Writing – review & editing, Supervision, Methodology.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2024.117581.

Data availability

Data will be made available on request.

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