



Article

What Do Pupils Learn from Voting Advice Applications in Civic Education Classes? Effects of a Digital Intervention Using Voting Advice Applications on Students' Political Dispositions

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Abstract: To what extent does the use of Voting Advice Applications in (digital) civic education classes at school impact students' political knowledge, attitudes, motivations and behavioral dispositions toward elections? This article provides answers to this question by presenting a sample analysis of the responses of 1189 pupils who participated in a digital civic education intervention, with the German Voting Advice Application Wahl-O-Mat at its core, whose usage was embedded in an elaborated didactical concept in civic education classes. Using a quasi-experimental field design with pre- and post-tests, the study shows that the intervention substantially improves students' knowledge of the investigated state election. Furthermore, we can trace a significant increase in young people's political efficacy and specific interest in the election campaign. Finally, we observe a substantial increase in intended electoral participation, especially among those adolescents whose intention to participate in elections was low prior to the intervention, which contributes to a reduction in existing participation gaps. In particular, we identify changes in motivational and cognitive political dispositions, but only to a limited extent evaluative and sociodemographic background variables, as key factors driving the intervention-induced change in willingness to participate in the state election. Our paper concludes by discussing the limitations of the study and its implications for empirical research and practice in civic education.



Citation: Waldvogel, Thomas, Monika Oberle, and Johanna Leunig. 2023. What Do Pupils Learn from Voting Advice Applications in Civic Education Classes? Effects of a Digital Intervention Using Voting Advice Applications on Students' Political Dispositions. *Social Sciences* 12: 621. <https://doi.org/10.3390/socsci12110621>

Academic Editor:
Christopher Wlezién

Received: 21 January 2023
Revised: 31 July 2023
Accepted: 15 August 2023
Published: 8 November 2023



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Keywords: Voting Advice Application; Wahl-O-Mat; state elections; civic education; intervention study

1. Introduction

Gamified instruments of election information on the Internet have become an integral part of pre-election communication in recent years (Marschall 2011). This was all the more true in times of the COVID-19 pandemic when classic formats of election communication were only possible to a limited extent. These online tools of gamified election information enable their users to compare their own political standpoints with those of political agents by taking a position on various issues and to obtain correspondence with the electoral offer as a ranking or graphical representation.

The proliferation of these so-called Voting Advice Applications (VAA) has gained international popularity at all political levels (Garzia and Marschall 2019). Due to their rapidly increasing outreach in the last two decades and their prominent position as an instrument of non-partisan election information on the Internet, VAAs have been widely researched internationally (Garzia and Marschall 2016). It has been repeatedly shown that gamified instruments of election information on the Internet have a variety of effects on their users: Not only do they support increased knowledge (e.g., Westle et al. 2014; Schultze 2014; Kamoén et al. 2015) and the formation of political attitudes (e.g., Alvarez et al. 2014; Andreadis and Wall 2014; Ladner et al. 2012; Mahéo 2016), but they also show effects on political engagement and involvement (e.g., Marschall and Schmidt 2008; Marschall and Schultze 2012; Fivaz and Nadig 2010; Gemenis and Rosema 2014), including the likelihood

to vote (Garzia et al. 2017). Existing studies on the effects of VAAs thus paint a powerful picture overall.

However, these findings essentially refer to the adult electorate or general population. Studies on the use of VAAs by young people who are just before or at the beginning of their electoral careers are largely lacking (Uyttendaele 2021). This is despite the fact that, first, they were originally considered the primary addressees of these tools and, second, the relevance of political socialization in adolescent years is recognized as crucial for the formation of political attitudes (Baumert et al. 2016). These patterns of attitudes tend to form by the time people reach adulthood and change relatively little thereafter (Rekker et al. 2017). In this respect, making politics and civic education attractive to adolescent citizens at a young age is crucial for the future vitality of (representative) democracy.

Against this backdrop, in view of the broad research corpus and the fairly uniform findings on the effectiveness of VAA use (for example, on voter turnout intentions), it is surprising that the extent to which VAAs—embedded in a didactically designed intervention in civic education at school—have an impact on students' political dispositions is largely unexplored (Uyttendaele 2021). In addition, there is a lack of knowledge about whether these effects are also evident in digital interventions of civic education in schools, as political didactic research paints an overall ambivalent picture of the effects of civic education in online settings (Weißeno and Eck 2013; Oberle et al. 2017; Ivens and Oberle 2020).

This article aims to contribute to closing these gaps. To this end, the article presents a concise analysis of the responses of 1189 students who participated in a digital civic education intervention during the Corona pandemic, at the core of which was the Wahl-O-Mat for the 2021 state election in Baden-Wuerttemberg, Germany (Waldvogel et al. 2023). Using a quasi-experimental field design with pre- and post-test, the study shows that the intervention substantially improves students' knowledge of the investigated state election. Furthermore, we can trace a significant increase in young people's political efficacy and specific interest in the election campaign. Finally, we observe a substantial increase in intended electoral participation, especially among those adolescents whose intention to participate in the election was low prior to the intervention, which contributes to a reduction in existing participation gaps. In particular, we identify changes in motivational and cognitive political dispositions, but only to a limited extent evaluative and sociodemographic background variables, as key factors driving the intervention-induced change in willingness to participate in elections.

The article is structured as follows: After a brief outline of both the state of research on Voting Advice Applications and on empirical research related to (digital) civic education interventions, we describe the aims and design of our didactical intervention as well as the data and methods used in the empirical study. This is followed by a presentation of the results from the analysis of the responses of the 1189 pupils who participated in the digital intervention, which didactically embedded the use of the Wahl-O-Mat in civics classes. The paper concludes with a discussion of the study's limitations and its implications for empirical research and civic education practice.

2. State of Research

2.1. Empirical Research on the Effect of Voting Advice Applications

The literature on gamified election information tools has grown rapidly since the mid-2000s (Walgrave et al. 2009; Louwense and Rosema 2014; Wagner and Ruusuvirta 2012; Garzia and Marschall 2016; Munzert and Ramirez-Ruiz 2021). The differentiated corpus can be broadly divided into two strands: One strand turns to the design of VAAs and examines the reliability and validity of programmatic positioning and outcome representations. A second strand focuses on users and the effects that VAA use has on the individual level. It focuses on different dimensions of political socialization, i.e., questions about political knowledge, political judgment and attitude formation, but also about individual motivations and behavioral aspects such as voter turnout (Munzert and Ramirez-Ruiz

2021). The following brief description of the state of research on VAAs will focus on this second strand because it is most relevant for the analysis that follows.

Schultze (2014) and Westle et al. (2014) show for the German context that the use of the Wahl-O-Mat has a positive influence on political knowledge, for example, about party positions on policy issues (currently also Munzert and Ramirez-Ruiz 2021). This finding is also confirmed in other national contexts (e.g., Kamoen et al. 2015; Alvarez et al. 2014). In addition, the Wahl-O-Mat has been found to stimulate further seeking of political information about parties, candidates and the election campaign among its users, thus promoting sustainable cognitive effects (Marschall and Schmidt 2008).

This mobilization of political knowledge and motivation to search for further information is seen as closely linked to the effects that VAA use has on both political attitude formation and action orientation. Thus, studies show, by means of individual voting intention, that the gamified tools of election information on the Internet help their users to further form their political attitudes. The somewhat mixed findings suggest, on the one hand, that VAA use can indeed change its users' voting intentions, but that this effect varies widely across national contexts and political levels, from 2 to as much as 10 percent (Walgrave et al. 2008; Ladner et al. 2012; Andreadis and Wall 2014; Dumont and Kies 2012; Kamoen et al. 2015; Wall et al. 2014). In addition, gamified tools of electoral information are attributed with an increasing effect on both voting intention and actual turnout. Although methodologically very diverse, a differentiated corpus of studies in Germany but also in international contexts proves that VAA use systematically increases the probability of voter participation among its users (e.g., Fivaz and Nadig 2010; Ladner and Pianzola 2010; Marschall and Schmidt 2008; Garzia et al. 2014; Gemenis and Rosema 2014; Marschall and Schultze 2012; Gemenis and Rosema 2014; Gemenis 2018; Germann and Gemenis 2019; Enyedi 2016; Garzia et al. 2017; Waldvogel and Wehner 2022).

With regard to the sociodemographic variables age and gender, Marschall and Schmidt (2008) show that it is primarily young female users who are mobilized to vote through the use of the Wahl-O-Mat. Other studies also share the finding that it is primarily young (Gemenis and Rosema 2014; Germann and Gemenis 2019) and female users (Fivaz and Nadig 2010) who attribute an effect on their own intention to vote to the use of a gamified tool for electoral information (unlike Marschall and Schultze 2012; Waldvogel and Wehner 2022).

The VAA research of the past two decades, with all its nuances, thus draws an overall positive picture with regard to the effects of the use of Voting Advice Applications such as the Wahl-O-Mat on different dimensions of political competence (Garzia and Marschall 2016). However, it must be finally noted that the most recent meta-analysis by Munzert and Ramirez-Ruiz (2021), on the one hand, provides evidence for positive effects of VAA usage on reported turnout, vote choice and knowledge. On the other hand, the variables are affected by large heterogeneity in effect sizes, for which the authors accuse study design to be a key driver since effects are substantively weaker in causally more rigorous experimental studies. This strikes in the same methodological vein as pointed out by Germann and Gemenis (2019).

2.2. Empirical-Quantitative Research in Political Didactics on (Digital) Interventions in Civic Education

Empirical-quantitative research in political didactics on the effects of civic education has also experienced a rise in the last twenty years, although the corpus is still quite small, not only with regard to civic education in Germany (Oberle 2018) but internationally (Donbavand and Hoskins 2021). Research on the effects of VAAs and civic education interventions show strong structural parallels, focusing in quite similar ways on analogous (latent) constructs of political competence resp. political dispositions.

For example, Oberle et al. (2018, 2020, 2023a) and Waldvogel et al. (2020) find—in the German context—positive influences of civic education interventions on participants' European and local political attitudes, respectively. This is in line with findings from the international research context, e.g., Belgium (Quintelier and van Deth 2014) or Czech

Republic (Šerek et al. 2017). With regard to internal political efficacy, empirical research from Germany also draws a positive picture, according to which students participating in political simulation games and interactive workshops are able to increase their discourse-related and more knowledge-related skills (Arens and Watermann 2017; Oberle and Leunig 2018; Oberle et al. 2018, 2020, 2023a; Waldvogel et al. 2020). Looking at the international literature on internal political efficacy (for a recent systematic review see Oberle et al. 2023b), we can find a wide variance in operationalization, ranging from single-items (e.g., Condon and Holleque 2013; Moeller et al. 2014) to extensive Likert-scale batteries (e.g., Murphy 2017; Kudrnac and Lyons 2018; Manganelli et al. 2014, 2015; Šerek and Machackova 2019). The latter usually distinguish between both subjective knowledge-related and discourse-/participation-related dimensions (Arens and Watermann 2017; Metzger et al. 2020). However, the latent constructs are in some studies fuzzily captured, especially in distinction to external political efficacy (e.g., Centellas and Rosenblatt 2018; Hoskins and Janmaat 2016; Leath and Chavous 2017), which casts doubt on the content validity of the item batteries (Oberle et al. 2023b). That is why the findings made have to be assessed cautiously. Against this backdrop, various studies have shown the great importance of internal political efficacy for young people's political participation and their willingness to vote (Moeller et al. 2014; Manganelli et al. 2014; Ellison et al. 2020). In the international literature, internal political efficacy is furthermore considered an important mediator variable (Manganelli et al. 2014; Maurissen 2020), also with regard to gender (Hoskins and Janmaat 2016; Pfanzelt and Spies 2019; Arens and Watermann 2017) and racial efficacy gaps (e.g., Centellas and Rosenblatt 2018). However, there are also studies that find an inverse direction of the relationship between internal political efficacy and political participation (Quintelier and van Deth 2014; Šerek et al. 2017), meaning that the impact of political participation on internal political efficacy is stronger than vice versa. Turning to external political efficacy, there is evidence—at least from the German research context—that this kind of positive impact of civic education interventions does not apply in the same way to the external dimension of political efficacy, as the effects here are rather weak (Oberle and Leunig 2018; Oberle et al. 2018, 2020, 2023a; Waldvogel et al. 2020). Regarding the cognitive dimension of civic learning, the results are quite consistent in the overall research corpus: for different topics and for different methodological approaches, interventions of civic education have been shown to substantially increase the subjective as well as objective knowledge of participating students (Hoskins and Janmaat 2016; Murphy 2017; Kudrnac and Lyons 2018; Manganelli et al. 2014; Levy 2018; Mariani and Glenn 2014; Hahn-Laudenberg 2017; Landwehr 2017; Oberle and Forstmann 2015; Oberle and Leunig 2018; Oberle et al. 2018, 2020, 2023a; Waldvogel et al. 2020). Looking at more motivational aspects, it is clear that civic education interventions can somewhat increase students' general interest in politics and strongly increase specific interest in, for example, a current election campaign (Claes and Hooghe 2017; Lawrason 2017; Zeglovits and Zandonella 2013; Oberle and Leunig 2018; Oberle et al. 2018, 2020; Waldvogel et al. 2020). The picture is more ambivalent for behavioral facets of political engagement. For example, no clear indication can be derived from the German research corpus that participation in a civic education intervention would fundamentally boost basal and advanced participation readiness among students. However, detailed analyses suggest that this might be explained in part by social desirability effects or overreporting, e.g., with regard to voter turnout and that groups with initially lower political dispositions may well be empowered in their participatory intentions (Waldvogel et al. 2020; Oberle et al. 2023a). In the international literature, only a few studies have examined the effect of (methodologically didactically designed) civic education interventions on an individual's willingness to vote or actual voter turnout. Based on a set of civic education interventions (school councils, debate teams and mock elections), Keating and Janmaat (2016) show that such activities can indeed have positive and independent medium-term effects on electoral participation, by encouraging political engagement from students even though they have left the confines of the school. Levy et al. (2019) provide evidence with their study that participating in an extended discussion-based

political simulation (including trial elections) can support various dimensions of high school students' political and electoral engagement. However, Öhrvall and Oskarsson (2020) do not find any effects when examining whether the propensity to vote in elections is higher among pupils from upper-secondary school who have previously experienced a student mock election.

This overall—beyond the limitations outlined—powerful picture of the impact of analogue civic education interventions on students' political dispositions cannot be fully endorsed on the basis of the few available studies for online-based interventions with students. Ivens and Franke (2021) document significant limitations regarding the effectiveness of the digital intervention surveyed in their study. Although the participants were able to slightly increase their subjective knowledge and internal efficacy, EU-related attitudes remained largely unaffected, as did external efficacy and both basic and advanced participation readiness. In their pilot study, Oberle et al. (2017), based on mean comparisons of the surveyed EU-related dispositions (knowledge, motivations and attitudes), cannot identify any significant changes between pre- and post-test. However, Ivens and Oberle (2020) show that design-based research can improve this situation, as the simulation games studied were able to increase their effectiveness in, for example, transferring EU knowledge to the participants following the scientific evaluation process (for a more general overview of international research in the context of digital approaches in civic education see Bombardelli and Ferreira 2016).

On the one hand, the few studies available show that civic education interventions can have positive effects on students' civic competencies. On the other hand, the findings are more mixed, especially with regard to studies that use digital tools for the intervention. Here, first, web-based applications do not seem to be necessarily superior to classical instruction based on analog attendance (cf. Weißeno and Eck 2013). Second, it does not seem to be a foregone conclusion that digital civic education applications, such as online simulation games, produce significant positive changes in students' dispositions (e.g., knowledge, motivation, attitudes) simply because it is a supposedly appealing method for the younger generation of *digital natives* (Oberle et al. 2017; Ivens and Franke 2021).

While the results on the impact of digital interventions in civic education embedded in an elaborated didactical concept are ambivalent, the findings on the effects of using VAAs such as the Wahl-O-Mat as an "isolated" online tool are clearly more encouraging (Garzia and Marschall 2016). Thus, VAAs are promising tools for civic education, but so far, their use in the context of civics classes with a clear didactical concept has hardly been focused by systematic empirical research. Therefore, the aim of the current study is to assess how Wahl-O-Mat usage didactically embedded into a digital intervention of civic education may foster students' political knowledge, motivations and, in particular, behavioral aspects of electoral engagement. Before the data analysis and results are presented, the data and methods of the field study, which follows a quasi-experimental design, are described.

3. Study Design

The following analysis examines the responses of students who took part in the digital program "Wahl-O-Mat on Tour" offered by the State Agency for Civic Education, Baden-Wuerttemberg. The target group consisted of students in grade 9 and above, at all secondary schools in the Freiburg administrative district. In the period from 15 February to 12 March 2021, a total of 94 events were held with around 2000 students. Data collection was carried out using a standardized online questionnaire at two measurement points (pre- and post-test) and was implemented using Unipark software. The survey was always conducted immediately at the beginning and at the end of the event. Owing to a code chosen by the respondents themselves (or their teachers), the digital questionnaires could be anonymized but still assigned to each other. The questionnaire consisted of closed questions about the young people's political dispositions (e.g., campaign interest, internal and external efficacy, intended election participation, subjective and objective knowledge about the state election), their evaluation of the event and sociodemographic information.

3.1. Sample

The sample on which the analysis is based includes responses from 1189 students who participated in both the pre- and post-surveys. The completion rate was 57%. We only considered cases for which answers were available for the corresponding items in both pretest and the posttest, even though individuals sometimes did not fully complete all questions of the respective test. Overall, the sample exhibits considerable heterogeneity: The gender ratio is almost balanced with 55% of female participants, and the age diverges between 14 and 24 years, with a mean of 16.58 years. With regard to the type of school, high schools dominate (57%), but the data cover almost the entire range of school types in Baden-Wuerttemberg, including vocational schools, secondary modern schools and cooperative schools. One-third (33%) of young people show little or very little interest in politics in general.

3.2. Didactic Intervention

At the center of the digital educational program was the Wahl-O-Mat for the 2021 state elections in Baden-Wuerttemberg. The “Wahl-O-Mat on Tour” format was developed by the State Agency for Civic Education, Baden Württemberg and implemented as e-learning on the Agency’s own Moodle platform, which students could work through independently, but with tutorial support via chat. The overall goal of the ninety-minute unit was to enable and motivate students to participate in state elections in line with their own interests and values. Specific aims were to enable the learners to (1) describe the essential basic values and principles of the relevant parties in the state elections in Baden-Wuerttemberg (AfD, CDU, FDP, Grüne, Linke and SPD), (2) compare the programmatic positions of the parties and (3) assess their own positions on issues relevant to young people in relation to the party positions.

The didactic concept essentially provided five modules for this purpose: In Module 1, the students were asked to state their positions on issues relevant to youth and state politics, as they were in the Wahl-O-Mat. In Module 2, the basic values and most important issues of the parties for the state election were to be worked out. These formed the basis for the application phase in Module 3, in which the learners were to play the Wahl-O-Mat from the perspective of one of the previously discussed parties. The goal was to achieve the highest possible agreement with the previously selected party. In Module 4, the participants were then given the task of evaluating the result using the example of youth-relevant theses on state politics in the form of an evaluation quiz. The last module, Module 5, gave the students the opportunity to reflect on what they had learned and the methods they had used.

3.3. Measurement Instruments

The items from the questionnaire are briefly outlined below. If not otherwise indicated, the constructs were collected in both the pre- and post-surveys. Due to a tight time frame and research practice limitations, most constructs could only be asked as single items, with the exception of the participants’ evaluation of (a) the intervention and (b) its perceived effects which were collected in the posttest by two respective three items and latently modelled. The questionnaire items are either adapted from the German Longitudinal Election Study (GLES 2019) or originate from previous studies by the authors (e.g., Oberle and Forstmann 2015; Oberle and Leunig 2018; Oberle et al. 2018, 2020, 2023a; Waldvogel et al. 2020, 2023).

Campaign interest. Specific interest in the state election was surveyed on eight levels (1 = I am not interested at all; 8 = I am very interested).

Efficacy. For individual efficacy, both internal and external dimensions were assessed on a four-point Likert scale. Internal efficacy was measured by the students’ self-assessment of the extent to which they think they can understand and assess important state policy issues. External efficacy was asked about agreeing with the statement that parties only

wanted voters' votes but were not interested in their concerns. For the analysis, the item on external efficacy was rescaled in reverse.

Subjective knowledge. Subjective knowledge about the state election was surveyed on eight levels (1 = I know nothing at all about it; 8 = I know a great deal about it).

Objective knowledge. Objective knowledge was assessed via a quiz consisting of five questions on the electoral system in Baden-Wuerttemberg, the parties and their positions on selected policy issues. Four response options were given per question, each with three distractors.

Willingness to vote. The (hypothetical) intention to vote was surveyed with the following question: "Suppose you were eligible to vote: How likely would you be to vote in the state election in Baden-Wuerttemberg?". Answers were recorded using a five-point Likert scale (1 = definitely not; 5 = definitely).

Evaluation. The evaluation of the program was assessed with two four-point Likert scaled items, one addressing the general satisfaction with the program and the second asking whether the students had enjoyed the course (Cronbach's alpha = 0.70).

Subjective learning effects. The learning effects were surveyed on a four-point Likert scale with the agreement to the following three statements: "The intervention has... (1) motivated me to inform myself further about the state election, (2) made me aware of state political issues and (3) made the differences between the parties clearer to me (Cronbach's alpha = 0.67).

Sociodemographic background variables. Gender was asked in three categories: female, male and diverse. Due to the very small number of cases, the last category could not be included in the analysis. Age was collected through a free text field entry. The type of school could be traced through the match of completion time of the online questionnaires and the appointments with the schools. Since the types of schools from the multi-tiered school system in Baden-Wuerttemberg are very unevenly distributed across the sample, the analysis only distinguished between high school students and non-high school students. In addition, general interest in politics was surveyed on a four-point Likert scale (1 = very little; 4 = very much) in the pre-test. For this purpose, students answered the question of how strongly they are interested in politics in general.

4. Analysis

4.1. Descriptive Findings of the Pre- and Post-Survey

Overall, the participants reported a very high level of satisfaction with the program and its learning effects. Thus, 95% of the participants were satisfied (36% "very satisfied") with the course they had experienced. Not only did an overwhelming majority of young people say that the digital intervention had been "fun" (88%), but it had clarified differences between the parties (90%) and made them aware of state policy issues (87%). Overall, slightly less agreement, but still at a very high level, is given to the statement that the digital workshop helped to further inform students about the state election (78%). The mean values of the calculated (latent) variables for surveying the event evaluation in Table 1 also show that the events are rated positively overall ($M = 3.22$), and the learning effects are assessed as high by the participants ($M = 3.14$).

The pre-post mean comparisons in Table 1 also reveal medium to very strong effects in the intended direction for almost all of the political dispositions surveyed. Especially, the intervention-induced changes in specific campaign interest, internal efficacy and objective knowledge, as well as in intention to participate in elections, are substantial. The change in the perceived subjective knowledge is outstanding: after the workshop, the students estimate this to be substantially higher than before (see Table 1).

Table 1. Mean comparisons of the surveyed constructs in the pre-test and post-test.

Construct	M Pretest (SD)	M Posttest (SD)	Cohen's d ¹	t-Test	Scale
Internal efficacy	2.51 (0.68)	2.95 (0.55)	0.64	21.95 ***	1 to 4
External efficacy	1.66 (0.78)	1.91 (0.70)	0.34	11.48 ***	
Campaign interest	3.88 (1.64)	4.72 (1.56)	0.79	27.04 ***	1 to 8
Subjective knowledge	3.28 (1.44)	5.00 (1.37)	1.40	47.91 ***	
Objective knowledge	2.74 (1.17)	3.60 (1.07)	0.67	22.31 ***	1 to 5
Willingness to vote	3.92 (1.16)	4.29 (0.93)	0.49	16.76 ***	
Evaluation		3.22 (0.56)			1 to 4
Subjective learning effect		3.14 (0.55)			

Notes: high mean values mean high agreement; standard deviation in parentheses; ¹ Cohen's d: d ≥ 0.20 = weak effect; d ≥ 0.50 = moderate effect; d ≥ 0.80 = strong effect; *** p < 0.001.

If we take a closer look at the single item on the willingness to vote (WTV for short; with a five-point Likert scale) in the election, for the total sample there is a positive, but statistically only moderately significant development from an already very high mean value of 3.92 to 4.29 (Cohen's d = 0.49; Table 1). Since motivating students to vote was a key aim of the didactic intervention and because students with a low voting intention are an important target group for civic education, it is interesting to illuminate how participation in the event affected young people who displayed different levels of willingness to vote prior to the intervention. Therefore, three groups with rather low (N = 173), medium (N = 206) and rather high (N = 808) willingness to vote were formed on the basis of the pretest responses and examined separately (see Table 2).

With regard to the sociodemographic characteristics of these three subgroups, Table 2 shows that there are hardly any differences in terms of gender and age. Regarding school type, high school students are less frequently represented in the group with a low intention to vote than in the other two groups. For voter turnout intention, it appears that individuals with a high prior willingness to participate in elections can hardly gain, which can probably be explained mainly by ceiling effects. On the other hand, those students who previously showed only a low or moderate willingness to participate in the election can benefit very strongly. With regard to the other items, all three groups were able to benefit significantly from the digital intervention in terms of subjective and objective knowledge, interest in the election campaign and internal efficacy. For subjective knowledge, this even applies in an outstanding manner. At the same time, a certain pattern emerges: In most categories, it is those individuals who previously exhibited a low or moderate willingness to participate in the election who benefit in a pronounced way from participation in the digital Wahl-O-Mat workshop, even though they remain below the level of the highly involved in all constructs even after the program. This pattern is somewhat limited for external efficacy, which experiences only minor intervention-induced changes overall and remains at a lower level. Overall, participation in the digital course of civic education does indeed seem to have contributed to reducing existing dispositional gaps.

As regards the evaluation of the course and its subjective learning effects, a pattern also emerges for the three subgroups, albeit in the opposite way: With a lower willingness to participate in the election, the evaluation is relatively lower, although in all groups the evaluation of the intervention and its effects is overall positive.

Table 2. Mean comparisons of the surveyed constructs in the pre-test and post-test for different subgroups of the willingness to vote (WTV).

	WTV Low	WTV Moderate	WTV High
N	173	206	808
Socio-demographic characteristics			
Male ³ (N/%)	80 (46.2%)	95 (46.1%)	343 (42.5%)
Age (M/SD)	16.75 (2.87)	16.22 (2.08)	16.63 (3.17)
Gymnasium ³ (N/%)	75 (43.4%)	120 (58.3%)	479 (59.3%)
Dispositions ¹			
WTV Pre	1.75 (0.44)	3.00 (0.50)	4.62 (0.49)
WTV Post	2.96 (1.07)	3.79 (0.67)	4.71 (0.54)
Cohen's d ²	1.20	1.17	0.17
Objective knowledge Pre	2.27 (1.12)	2.49 (1.23)	2.90 (1.13)
Objective knowledge Post	3.44 (1.13)	3.49 (1.08)	3.66 (1.05)
Cohen's d ²	0.87	0.79	0.61
Internal efficacy Pre	2.17 (0.77)	2.38 (0.58)	2.61 (0.55)
Internal efficacy Post	2.82 (0.68)	2.84 (0.50)	3.01 (0.52)
Cohen's d ²	0.76	0.68	0.61
External efficacy Pre	1.46 (0.88)	1.61 (0.78)	1.72 (0.75)
External efficacy Post	1.76 (0.71)	1.91 (0.69)	1.94 (0.70)
Cohen's d ²	0.34	0.40	0.32
Subjective knowledge Pre	2.33 (1.17)	2.78 (1.14)	3.61 (1.43)
Subjective knowledge Post	4.20 (1.34)	4.62 (1.25)	5.26 (1.32)
Cohen's d ²	1.45	1.47	1.37
Campaign interest Pre	2.44 (1.36)	3.23 (1.28)	4.36 (1.54)
Campaign interest Post	3.61 (1.56)	4.22 (1.38)	5.08 (1.44)
Cohen's d ²	0.94	0.93	0.72
Satisfaction	3.00 (0.63)	3.14 (0.48)	3.29 (0.54)
Subjective learning effects	2.88 (0.69)	3.06 (0.51)	3.22 (0.50)

Notes: ¹ high mean values mean high agreement; standard deviation in parentheses; ² Classification according to Cohen's d: d ≥ 0.20 = weak effect; d ≥ 0.50 = moderate effect; d ≥ 0.80 = strong effect; ³ Type to 100%; all t-tests of the pre-post mean comparisons significant at level $p < 0.001$.

4.2. Regression Analysis Explaining the Change in Willingness to Vote

In this subsection, we want to assess which factors explain the difference in students' willingness to vote before and after participating in the digital Wahl-O-Mat workshop. For this purpose, we estimated an OLS regression. The dependent variable, that is, the variable to be explained, is the difference in willingness to vote (hypothetically) in the state election between the post- and pre-surveys. Positive values thus indicate an increase in the willingness to vote and negative values a decrease.

This regression analytical approach is theoretically based on the assumption that intervention-induced changes in students' political dispositions lead to an increase in willingness to vote according to an individual psychological pattern, as is known from the broad corpus of political behavior and election research (seminal [Campbell et al. 1960](#)). Consequently, in addition to sociodemographic background variables (age, gender, school type), motivational (specific campaign interest, internal and external efficacy), cognitive (subjective as well as objective knowledge) and evaluative (general satisfaction as well as subjective learning effects) constructs are considered as potentially explanatory factors. With the exception of the evaluative and sociodemographic items, the explanatory variables are operationalized dynamically, that is, the difference in the ratings of post- and pre-survey is generated. Thus, here too, positive values generally indicate an increase in the construct, while negative values indicate a decrease. In order to obtain more comparable effects in the model, all variables assumed to be metric are put on a uniform scale (1–5) before estimating the regression.

Figure 1 shows the result of the regression analysis. Shown are the unstandardized b-coefficients together with 95% confidence intervals (the full model is tabulated in [Table A1](#)). At the outset, we note that adjusted R^2 is low overall at 0.14 (see [Table A1](#)). However, since this analysis follows an x-centered approach, a lower R^2 seems justifiable.

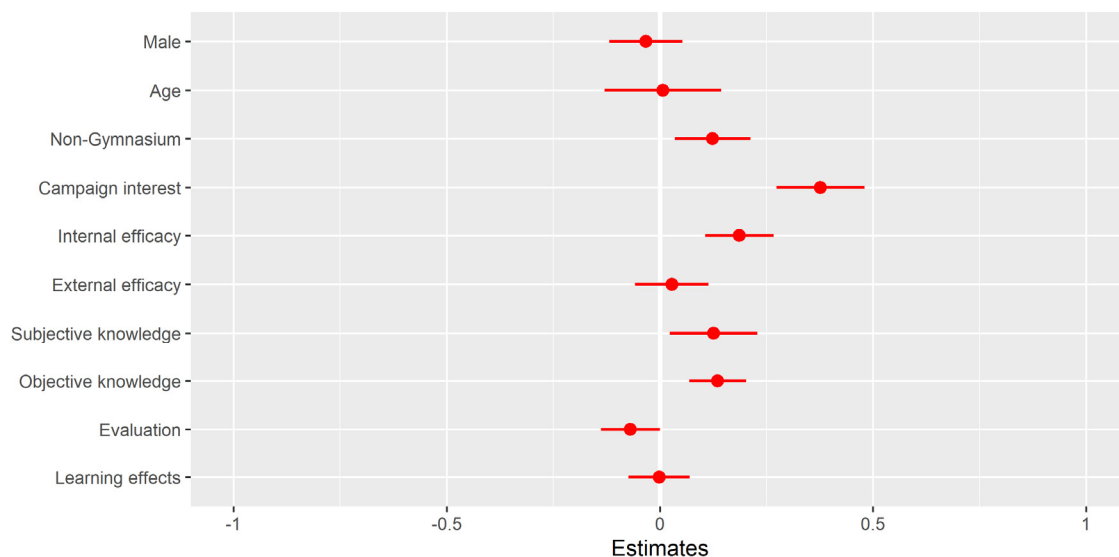


Figure 1. Regression Analysis Explaining the Change in Willingness to Vote. Notes: $N = 1035$; shown are non-standardized b-coefficients including 95% confidence intervals from a linear regression model. Reading examples: A one-point higher assessment of one's own campaign interest (on a scale of 1–5) with respect to the state election is associated with an approximately 0.38-point higher intention to vote (scale 1–5). The confidence interval, which does not intersect the zero line, indicates that this effect is significant, i.e., not equal to zero, with a probability of more than 95 percent.

Regarding the different constructs, the socio-demographic background variables gender and age show no influence on the change in willingness to vote. On the other hand, the type of school does have an impact. Students from schools beyond the Gymnasium are more strongly mobilized to participate in the election, which can also be plausibly explained by the larger mobilization reserve in this group. The motivational variable on the Increase of interest in the election campaign shows the strongest effect of all metric-rescaled variables, which are therefore comparable in their effects. Strengthening internal efficacy through the intervention can also contribute to participatory mobilization as a behavioral component. With regard to the constructs that map students' cognitive mobilization (subjective and objective knowledge), it appears that these are positively associated with participatory mobilization. This is especially true for the increase in objective knowledge.

The variables that capture the evaluative dimension, more specifically the assessment of subjective learning effects and the general evaluation at the end of the workshop, do not show a statistically significant effect on intentional electoral participation.

5. Discussion, Implications and Limitations

With our study, we tried to answer the question of to what extent the use of Voting Advice Applications in (digital) civics classes affects students' political knowledge, attitudes, motivations and behavioral intentions about elections and contributes to their participatory mobilization. For this purpose, we analyzed the responses of 1189 students who participated in a digital civic education intervention with the Wahl-O-Mat for the 2021 state election in Baden-Wuerttemberg at its core. With our study, we were able to show that the intervention, first, substantially improved students' knowledge of state policies. The Wahl-O-Mat workshop thus seems to have led to a cognitive mobilization of the participants, and this not only with regard to the subjective assessment of their own level of knowledge, but also with regard to objective knowledge. It is noteworthy here that it was particularly those students with a low and moderate dispositional voting tendency who benefited cognitively from the intervention. This pattern also holds for the considerable increases in adolescents' internal efficacy and campaign interest. Finally, we also observed a significant increase in intended voting participation, particularly among those youth whose pre-intervention willingness to vote was low or moderate. Although all subgroups experienced major gains as a result of participation in the Wahl-O-Mat workshop, it was again the two groups with low and moderate dispositional intent to vote that experienced particular gains, although the absolute values in all constructs still lagged behind the highly involved group after the intervention. Overall, then, we see that the digital didactic intervention with the Wahl-O-Mat at its core was very effective and contributed to a reduction in existing participation and knowledge gaps.

This finding about the disparate distribution of cognitive and participatory gains from civic education interventions in favor of those with less pronounced political predispositions is not only in line with recent work in empirical research on political didactics (e.g., [Oberle et al. 2018, 2020](#)), but also corresponds to research on VAAs ([Marschall and Schmidt 2008](#); [Fivaz and Nadig 2010](#); [Gemenis and Rosema 2014](#); [Waldvogel and Wehner 2022](#); conversely, [Marschall and Schultze 2012](#)).

The fact that our empirical results contradict a knowledge gap hypothesis, according to which especially those people benefit from (civic) education who have high (cognitive) resources anyway is also shown in our analysis of the factors that drive the change in willingness to participate in the election. Thus, students from school types beyond high school in particular can benefit participatively from attending the digital intervention with the Wahl-O-Mat. While changes in objective knowledge and internal efficacy are also explanatory factors, state political campaign interest emerges as the strongest driver of participatory mobilization.

Although the findings summarized here appear quite consistent, they are subject to multiple limitations. First, the constructs we surveyed are predominantly based on single items, which may inadequately capture the rich content of the latent constructs. Second, our study does not provide insights into students' more qualitative statements about the intervention and its effects, which would provide deeper insights into the effect mechanisms of VAA-based interventions on students' political dispositions. Third, our study design captures only short-term effects of the intervention because no follow-up survey was conducted. Thus, we cannot make any statements about how sustainable the demonstrated effects are ([Manzel and Zischke 2022](#)). Fourth, the effects of self-selection are to be expected in our study, since it is based on a convenience sample and the sample was not randomly assigned ([Uyttendaele 2021](#)). Rather, its composition depends on the willingness of, first, the teachers to participate in a digital civic education program for the state election and, second, the students to answer the surveys immediately at the beginning and end of the workshop. Fifth, the study design does not include a control group to validate the actual impact of the

implemented interventions, as is appropriate for an experimental study protocol. Rather, the study has the character of a quasi-experimental field study (Gaspard and Trautwein 2021). Sixth, there was little control over the background setting during the survey. Since all students were homeschooling, we can assume a similar context, but the individual settings likely differed considerably in many respects (e.g., spatial and technology). Thus, the latter three points violate key requirements of an experimental study protocol with significant limitations on the internal validity and generalizability of the findings. On the other hand, our quasi-experimental approach in a field study allows for greater authenticity of the digital intervention in everyday school situations of Corona-induced lockdown, which should increase acceptance among participants as well as the external validity of the findings, while at the same time our procedure ensures a substantial degree of standardization and control in the process of data collection (Waldvogel et al. 2020).

Despite the limitations outlined above, the study presents relevant findings given the sample's size and heterogeneity rarely found in empirical research on civic education interventions (in Germany) (Oberle and Forstmann 2015; Landwehr 2017; Hahn-Laudenberg 2017; Waldvogel et al. 2020). Our findings are also in line with current research both in political didactics and in the research strand on VAAs that focus on their mobilization effects (Marschall and Schmidt 2008; Fivaz and Nadig 2010; Gemenis and Rosema 2014; Waldvogel and Wehner 2022; Uyttendaele 2021). Overall, our results show that digital civic education (enforced by the Corona lockdowns) has the potential to foster a broad range of competencies among students, despite all concerns.

Against the backdrop of our findings, it seems valuable for empirical research in political didactics to compare online interventions and those based on analog presence in the classroom in order to elicit specific conditions for success in different settings. By including control groups which either only use the VAA without any specific didactical embedding or which do engage with upcoming elections but without the use of a VAA, further insights can be obtained regarding the special potential (a) of the VAA tool and (b) of didactic strategies to use VAAs in civic education. Further studies should also include a third point of measurement to analyze longer-term effects, as well as qualitative research such as open-ended questions on subjective learning effects or interviews with participants. In addition, it must be noted that this is a single case study. Didactic research on VAAs should strive to adopt a more intra- and international comparative perspective in the future, and also to take into account the influence of the different designs of the school system and how this impacts the effect of VAAs, e.g., if there is no separate school subject for civic education. Although external validity is not beyond doubt due to our study design and practical research constraints, it seems plausible to assume that similarly methodologically and didactically designed programs have the potential to be an effective intervention of civic education in other educational contexts. The key here appears to be the embedding of VAA use in an overall methodological-didactic concept as well as a professional implementation of both teaching civic education and collecting research data—a prerequisite is that not every school system can offer due to a lack of structures.

For the practice of civic education, our findings suggest the potential of integrating the use of VAAs in (digital) civics classes into a specially developed methodological-didactic concept. The (short-term) changes in students' cognitive, motivational and behavioural competencies achieved by this approach are not only compelling but could also contribute to the achievement of the guiding principle of the intervening citizen (Breit and Massing 2002) and thus to the vitality of (representative) democracy in the future (Uyttendaele 2021). Of particular value are the compensatory effects demonstrated by this study which result in reducing, e.g., motivational and participatory gaps in youth with different backgrounds. Especially in light of the factual lowering of the voting age to 16 in some German states (e.g., currently in Baden-Wuerttemberg) and the elections to the European Parliament in Germany as well as prospectively for the Bundestag elections, it is obvious to methodically didactically exploit the potential revealed in this study through the use of VAAs in civic

education, regardless of whether this is conducted digitally in homeschooling or in analog presence in the classroom (Waldvogel and Wehner 2022).

Author Contributions: Conceptualization, T.W., M.O. and J.L.; methodology, T.W., M.O. and J.L.; formal analysis, T.W., M.O. and J.L.; investigation, T.W., M.O. and J.L.; resources, T.W.; data curation, T.W.; writing—original draft preparation, T.W., M.O. and J.L.; writing—review and editing, T.W., M.O. and J.L.; visualization, T.W.; supervision, T.W.; project administration, T.W., M.O. and J.L.; funding acquisition, T.W. All authors have read and agreed to the published version of the manuscript.

Funding: The APC was funded by Open Access Publication Fund of the University of Freiburg.

Institutional Review Board Statement: Ethical review and approval were not necessary for this study according to German legislation and the guidelines of the German Research Foundation (DFG). No personal data was saved. All analyses are thus based on anonymous data. The survey was conducted following German General Data Protection Regulation (DSGVO).

Informed Consent Statement: Informed consent was obtained from all subjects (or their legal guardians) involved in the study.

Data Availability Statement: The datasets generated and/or analysed in the current study are available upon reasonable request from the corresponding author as well as the R-script used.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Full regression model explaining the change in willingness to vote.

	Model 1
(Intercept)	−2.00 *** (0.27)
Male	−0.03 (0.04)
Age	0.01 (0.07)
Non-Gymnasium	0.12 ** (0.05)
Campaign interest	0.38 *** (0.05)
Internal efficacy	0.19 *** (0.04)
External efficacy	0.03 (0.04)
Subjective knowledge	0.13 * (0.05)
Objective knowledge	0.14 *** (0.03)
Evaluation	−0.07 (0.04)
Subjective learning effects	−0.00 (0.04)
N	1035
R ² adj.	0.14

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

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