
FAKE
FACT

Project Report **CheckMate**

Today's digital world is filled with an abundant amount of information, both reliable and unreliable. With the rise of social media, it has become easier than ever for false information to spread quickly. As such, it has become increasingly important to be able to detect fake news when they encounter it. Fortunately, there are a number of strategies that can be used to help detect fake news, allowing to make more informed decisions. Our interactive tool aims at improving the capability of German high schoolers to detect fake news by confronting them with real and fake news.

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Preface by the Supervisors

Prof. Dr. Sophie Armanini and Prof. Dr. Tilman Michaeli

We are honored to present Checkmate, a student project dedicated to promoting critical thinking and digital literacy. Thanks to the collaborative efforts of a highly motivated and multidisciplinary group of students, this project has made a valuable contribution to equipping young people with the tools to navigate the complex and often deceptive world of information.

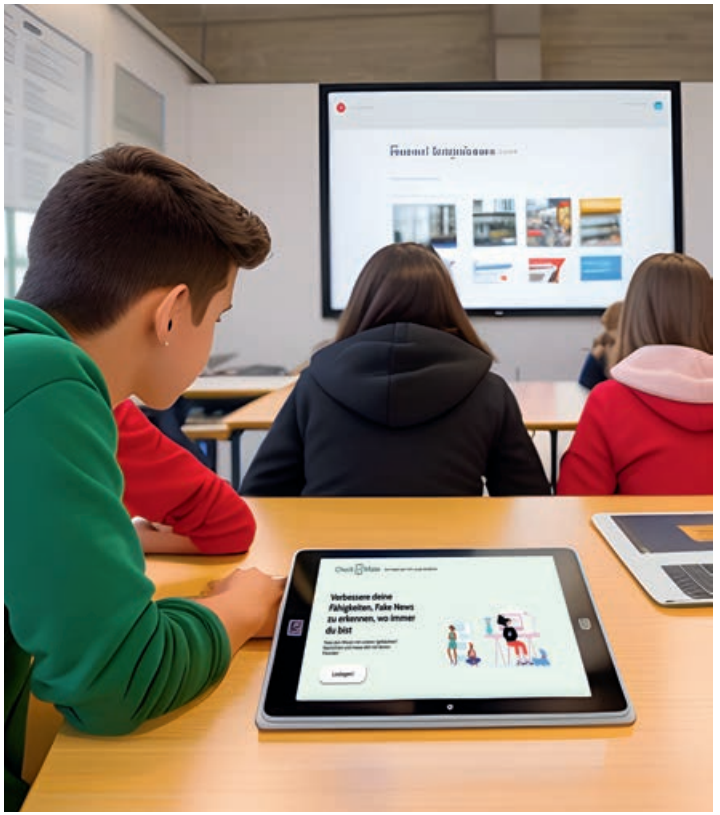
Checkmate is a comprehensive initiative aimed at improving K-12 students' ability to identify fake news. At its core, the project recognizes that the proliferation of false information is a growing threat to our society and that it is increasingly important for individuals to separate fact from fiction. To this end, the team Checkmate has developed an innovative digital teaching tool that has been success-

fully tested in high schools across Bavaria. Through real-life examples and interactive exercises programmed into a custom-built app, students are encouraged to engage with news and media critically, identify markers of falsehood and deception in an interactive and intuitive way, and share their insights with their peers.

What makes this project truly outstanding is its emphasis on empowering young people to become active and informed citizens capable of confidently navigating the complex terrain of the modern media landscape. The project not only fosters the development of essential critical thinking skills but also promotes a sense of responsibility and engagement that is valuable in all areas of public life.

At a time when misinformation and fake news are increasingly prevalent, it is vital that we promote digital literacy and critical thinking. This student project is a model for how we can equip the next generation with the skills and knowledge they need to navigate the complex world of information. We are honored to have mentored this talented group of students throughout their project and proud to showcase their accomplishments. ■

Successful training for detecting fake news



Even small stimuli can help pupils better debunk misinformation

Even simple clues, such as paying attention to the source of fake news articles, lead to a significantly better ability to distinguish between correct and false information in the form of news articles.

This is the result of an educational intervention based on a self-developed web app conducted by the student research team CheckMate of TUM: Junge Akademie. Pupils of grades 10 to 12 at three Munich high schools participated in November and December 2022. The aim was to increase the ability to detect fake news.

Furthermore, the study showed that even a short training period leads to first small improvements in fake news recognition among pupils. To achieve long-term and significant effects, larger scale initiatives would be essential in the combat against fake news and their propagation.

During the intervention of the TUM team, implemented in a 45-minute school lesson, pupils from Gymnasium Derksen, Gymnasium Kirchheim and the European School Munich were exposed to a web app containing a total of 24 articles retrieved from online portals of traditional newspapers and from social media. Among these were articles from online magazines such as “Rubikon” which frequently comments on political events in the form of conspiracy theories. The pupils were instructed to assess the veracity of the presented articles on a 5-graded scale from “fake” to “true” while being divided into two groups: The treatment group received immediate feedback on whether the rating was correct along with indications on typical characteristics of fake or real news articles after each question, whereas the control group moved on to the next article without feedback. Significant performance differences could be observed: For example, a truthful article about the use of a diabetes drug to lose weight was rated as “rather true” or “true” by 83 percent of the treatment group, compared with only 47 percent of the control group. However, such results were not observed for all questions.

Commentary

Even US-presidents have their own concept of truth and mass media. Former president Donald Trump for instance, when he stated: “Any negative polls are fake news, just like the CNN, ABC, NBC polls in the election. Sorry, people want border security and extreme vetting.”

This is what Donald Trump tweeted on February 6, 2017 in response to the named media outlets’ predictions regarding the preceding US presidential election he won against Hillary Clinton, the Democrat’s candidate at that time.

Particularly interesting about this testimony to Trump’s relationship with the truth, who back then was arguably one of the most powerful men on the planet, is how it underlines the fundamental issues related to fake news in our modern world: Anyone can distribute a piece of information around the entire globe within a matter of seconds. Once the enter-key is hit, there is hardly a way of stopping it. Making its way through a dense forest of statements and responses, of subjective opinions and objective propositions, of true statements and lies, the contained message, be it truthful or not, experiences an evolutionary process of multiplication, adaptation and alterations – this single Tweet alone has over 50 000 replies.

Next to its dynamic and the lack of external control, the multi-layered nature of today’s media landscape adds a further level of complexity. Not only via social media, also via the “conventional” channels such as TV and newspapers, information is spread quicker and in larger quantities than ever before – making it easier to lose sight of what is true and what is not. Yet especially in digital formats, where a predominantly younger audience is targeted, the issue of fake news is very prominent. It is hence of major importance to educate and train adolescents in their handling of the information they are being addressed by.

A small, yet important step in this direction was recently made by the research initiative CheckMate, who successfully built and launched a digital training application educating German high schoolers on how to identify such fake news articles. Statistical analyses comparing the performance of the study’s participants exposed to an educational treatment to that of a control group in their ability to discern false from true information indicates the training’s potential to significantly improve detection rates. The next step must now be to increase the reach of the application and by making it available to a wider range of students in order to better equip the upcoming generation with the skills essential to survive in this modern jungle of information, where even some of our society’s most impactful leaders may contribute to this crisis – for instance by disseminating false allegations about truthful outlets arguably disseminating false allegations. What an irony – too bad the topic is far too serious and the problems far too severe to be subject to a joke. ■

A fake news competency training web app increased the misinformation detection skills of high school students

Abstract
The spread of misinformation over digital media influences public opinion and societal decision-making. Teenagers and adults in their twenties use digital media and encounter misinformation frequently. To address this challenge, we developed a scalable, web-based application that trains students in fake news detection by pointing out typical characteristics such as sources, graphic style, or writing style of such texts. In this work, we investigated whether this application improves high school students' misinformation detection abilities in nonfiction news articles compared to a control group. N = 104 participated in the intervention study. We found that if the students got feedback on typical characteristics of fake news articles, their ability to discern these from articles with accurate content increased significantly compared to the non-feedback control group (p = .0003). Our results confirmed that our application could be used in the future for training students' fake news detection capability.

Background
The dissemination of false and misleading information, often called "fake news," has become a significant concern in today's society. The use of social media and messenger apps accelerates the dissemination of misinformation articles compared to traditional news media (Feierabend et al., 2017). According to a study by Vosoughi and colleagues, fake news on Twitter spread six times faster than accurate information (Vosoughi et al., 2018). The consequences of this can be severe: Repeated exposure to fake news is known to increase belief in fake news (Pennycook et al., 2018). At the same time, trust in legitimate news sources is being undermined (Hasebrink et al., 2021). Trusting misinformation can lead to dangerous actions such as injecting oneself with bleach after it was proclaimed as a supposed cure in light of the COVID-19 pandemic (World Health Organization, 2020a) or the alleged targeted demobilization of Democratic voters in the 2016 US election by Russian trolls and bots which eroded trust in democratic institutions (Zeit Online, 2018).

Misinformation poses a significant risk to adolescents in particular, as they frequently use the internet as an information source. In Germany, 60 % of 16–25-year-olds agree that the internet is the best way to gather information, while only 25% rely on print media (comdirekt, 2019). However, during the use of digital media, they often encounter misinformation. 56 % of 12–19-year-olds said they had encountered fake news online (Feierabend et al., 2022). These circumstances necessitate the development of methods to prevent the adverse effects of fake news.

Two different approaches to limiting the spread of misinformation exist. First, misinformation can be addressed by social media platforms directly. Here, social media companies implement interventions on a content-level and on an account-level. The content-level intervention through automatic or manual moderation consists of flagging (i.e. adding a warning to content that is misleading) or deleting articles. Research on flagging has shown mixed results. While cognitive activity is increased by fake-news flags, confirmation bias prevents an impact on the user's judgment (Moravec et al., 2019). Other studies have found that flagging significantly reduces the believability and spreading of fake news (Ng et al., 2019). The account-level intervention consists of, for example, deleting the accounts that post misinformation. However, new accounts can be created by publishers.

The second approach to limit the spread of fake news works on an individual level by strengthening the individual response to misinformation seen online. Fact-checking websites provide additional information to enable consumers to evaluate the facticity of a shared news article. Alternatively, educational methods aim to strengthen critical media competencies (Lazer et al., 2018). One framework for educational intervention is the inoculation theory. The inoculation theory assumes that pre-existing attitudes determine a consumer's response to media. It proposes presenting a weakened version of misinformation and to point out relevant characteristics of misinformation. Individuals are taught to criti-

cally evaluate information and become more aware of counterarguments and of how to identify future pieces of misinformation. Two components are essential for a successful inoculation. First, a clear indication that misinformation is presented. Secondly, a clear explanation of the typical arguments and characteristics of misinformation (Cook et al., 2017).

Different methods of inoculation have been investigated in the literature. Brashier et al. evaluated how the timing of a "false" or "true" tag affected the assessment ability of fake news when rating the veracity of headlines of fake news in the long run. They found that providing fact-checks after the headline was classified the most effective (Brashier et al., 2021). In another intervention from Südwestrundfunk, people were taught to recognize and distinguish real and fake news. The website SWR Fakefinder asked users to classify online articles in a social media context as "fake," "true," or "satire." After the assessment, the correct answer was provided immediately (SWR Fakefinder, 2023). A study published by Roozenbeek and van der Linden developed a "fake news game" in which participants are asked to actively create news articles about the European refugee crisis using misleading tactics and from the perspective of different types of fake news producers. The results provide preliminary evidence that playing the fake news game reduces the perceived reliability and persuasiveness of fake news articles and suggest that educational games may be a promising tool to inoculate the public against fake news (Roozenbeek & van der Linden, 2018).

This work aims to develop and test a web app to be used as an intervention for high school students. The web app is designed after the principles of inoculation theory outlined above. We thereby transfer prior research results on inoculation theory into the classroom environment. There, the web app can be easily integrated into the standard educational structure of high school students. Media literacy is already part of the curriculum in German high schools (Kultusministerkonferenz, 2012). Therefore, we investigated to what extent our custom-developed web app improved the ability of German high schoolers to identify fake information alongside its distinctive characteristics. Moreover, our study gathers insights into the status quo of the fake news literacy of German high schoolers while aiming to reduce the impact of fake news on society by promoting a better-informed youth population.

Goals and Methods

Research Rationale

This study aimed to measure and improve German high schoolers' fake news recognition capabilities in grades 10 through 12. We define fake news recognition capability as being able to correctly assess presented news articles and classify them as "fake" or "true." The proposed short-time intervention, focused on short-term learning processes, was based on the inoculation theory. We aimed to answer the following research question: “To what extent does our developed web app increase the capability of German high schoolers to identify fake information alongside its distinctive characteristics?”

Study Design and Intervention

The study was conducted in sessions which lasted 45 minutes. First, the relevance of fake news was briefly explained. The use of the developed web app constituted the second part of the session, which lasted 20 minutes. Students were introduced to the use of the web app and accessed it on their individual devices. First, they entered personal data including age, gender, weekly media consumption in hours, and a self-assessment of their fake news recognition capability on a five point likert scale of 1 (=unable to identify misinformation) to 5 (=certain to be able to identify misinformation). After entering the data, 24 news media articles were shown to the participants one by one (12 factual, 12 fake). All students saw the articles in the same, predefined order. They were then asked to grade each article on a 5-point scale, respectively (1 = "fake," 2 = "rather fake, " 3 = “do not know, " 4= “rather true,” 5 = “true”). Students were assigned randomly into equally sized control and intervention groups per class. After each response, the intervention group received feedback on their answer. The control group was shown the next article directly. The feedback consisted of the solution to the question and feedback on two to three relevant cues to detect possible fake articles, e.g. picture sources, publisher information (or lack thereof), general appearance of the article and web site, characteristics of text, language, and writing style. Figure 1 shows the user interface during feedback. We asked participants to answer the questions independently of their peers. They were also unaware of the existence of a control and intervention group. At the end of the experimental session, fake news characteristics were discussed in an open discussion within each class.

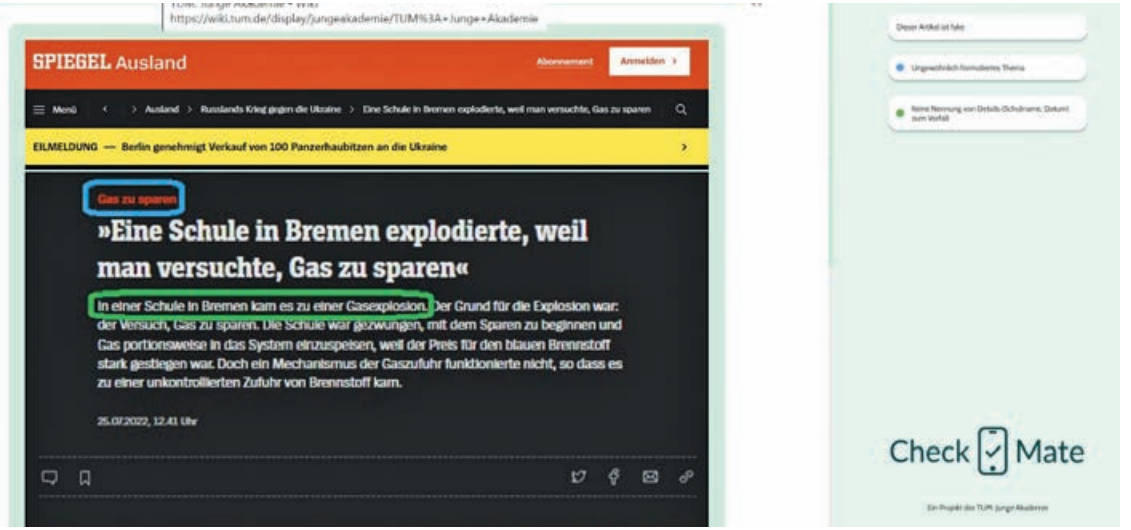


Figure 1: Example of feedback the intervention group received after answering a question.

Recruitment of High Schools

The team CheckMate first contacted high schools and spoke with the school administrators of interested institutions. The study design, intervention, and research questions were explained, including the possible benefits for students. Finally, the teachers were asked to consider allowing the team to conduct the intervention with their students. Three high schools participated in the study, with two, three, and four classes (grades 10 to 12), respectively. This enabled comparisons of the students' capability to detect fake news between different grades within the same high school.

App development and data collection

The web-based application was developed using Python, and the Javascript framework React. The user interface was designed using Figma. The articles were collected as screen captures from social media, personal blogs, popular media outlets, the German-FakeNC database (Vogel et al., 2022), and fact-checking websites. The complete list of articles can be found in the supplementary material. The web app's performance was pilot tested with 20 TUMJA scholarship holders in advance. The user's response and the response time stamp were collected for every article presented. Data was collected and saved in a PostgreSQL database.

Data Analysis

Classes from grades 10-12 at three German high schools were visited, resulting in a total of N =104 participating students ($n_{treatment}$ = 51, $n_{control}$ = 53). The average age was 16.02 years (SD = 0.94). In total, 49 males (≈ 47%), 51 females (≈ 49%), and 2 diverse (≈ 2%) participants took part. The average weekly media consumption in hours was 11.45 (SD = 13.15), and the self-assessment of their fake news detection ability was, on average, 3.23 points (SD = 0.88) out of five. Fake news detection scores were calculated as follows (Equation 1).

Equation 1: Calculated score based on the student's answers.

$$real\ article = \frac{2 - score}{2} \qquad fake\ news\ article = \frac{-2 + score}{2}$$

As a nonparametric test for ordinal data, a Mann-Whitney U test was performed, treating each question as an individual data point with the relevant group features (treatment or control) and score. For each of the tests, we set the significance level to 0.05. The score was determined on an ordinal scale ranging from -1 (wrong answer) to 1 (correct answer). Intermediate values of 0 and ±0.5 were assigned for neutral answers and answers expressing uncertainty in their choice. In the following, the analysis is based on

questions 7 through 24 excluding question 18. As the participants were drawn from the same group, we expect them, on average, to perform equally before the intervention takes effect. We expect an initial learning period to be required before the treatment group can differentiate articles better than the control group. Therefore, we do not consider questions 1 through 6. Article 18 is an outlier, as the treatment group drastically underperforms compared to the control group (Intervention Group: -0.17 vs. Control Group: 0.23). We assume that this is a result of the design of previous interventions and is not related to the actual performance of the intervention group. This issue is further addressed in the discussion under "Difficult Articles." We therefore also exclude this article from our analysis.

Outcomes and Discussion

Overall, we can observe that our intervention significantly improves students' ability to recognize fake news ($z = 3.25$, $p < 0.003$, $r = .078$). We obtain a p-value of 0.003, showing that our findings are statistically significant, although a Pearson Correlation coefficient of only $r = 0.078$ indicates a very small effect. Figure 2 shows that the mean score of the intervention group is higher than the control group's mean score in eight out of nine of our experimental sessions.

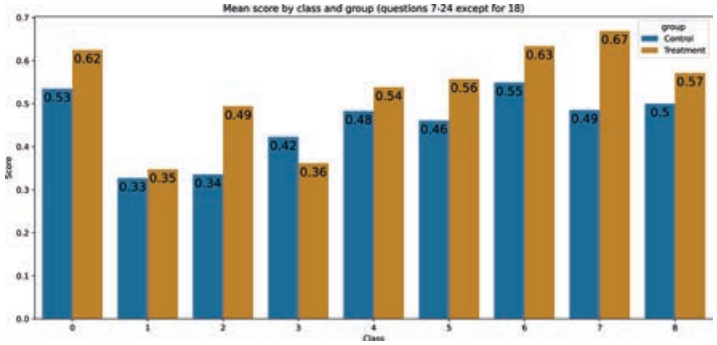


Figure 2: Mean Fake News Detection score by class and experimental group.

Results

The mean score of the control group over all experimental sessions is $M = 0.44$, whereas identifying every article correctly corresponds to $M = 1$. The difference between actual score and perfect score highlights the relevance of raising fake news awareness and underlines the clear room for improvement in the students' capability to identify them.

For our intervention, we find that the intervention group performed significantly better than the control group with a p-value of 0.01 (medians: treatment = 1, control = 0.5, $U = 398813.5$, $n_{treatment} = 825$, $n_{control} = 883$, $p < 0.01$). In our case, it only take twelve solutions of fake news articles in combination with the feedback suffice to cause a small, yet not negligible effect ($r = 0.093$). This effect could be attributed to two causes. Firstly, it may stem from the difference that the intervention group receives the solution immediately after answering each article, compared to the control group, which receives the solutions at the end of the session. The positive impact of providing solutions immediately has been shown before and is associated with studying over extended periods of time (Biktimirov & Klassen, 2010). Secondly, the learning effect can originate from the intervention itself. We assume the intervention works immediately: The tool identifies typical characteristics of both articles with and without misinformation. Equipped with these characteristics held in short-term memory, intervention group participants can apply what they have learned so far when they are confronted with the same characteristics in similar texts during the following questions.

While the initial results are promising, the effect's strength is limited by the low number of training examples (i.e. articles and feedback) the students received and the short time they spent on the exercise in total. We presented only 24 articles in 20 minutes during a single session to the subjects. Presenting more articles and increasing the study time could improve the learning outcome. We suggest separating the exercise into multiple training sessions, as the task is reading intensive. It could be shown in past research that spaced practice increases the efficiency of learning (Kang, 2016). Therefore, we suggest a longer break in between exercise sessions (in the order of days/weeks).

Differences in Mean Score between Experimental Sessions

Figure 2 shows huge variations between the experimental sessions ($SD = 0.060$). We hypothesize two reasons for this. The first reason is demographic variation between the classes. For one, the classes that participated in our experiments are from three different high schools, so we expect that regional differences play a role. Furthermore, the classes also differ in their age structure, as they are from different school years. We found that age is an important parameter for fake news detection skills. Therefore, classes with different age structures are expected to obtain dif-

ferent results. Figure 3 shows the mean score across age groups (M_{age} = 16.0 SD_{age} = 0.94). We can see that the scores increase with age. This result can be explained by the greater experience which the older participants presumably have with navigating digital media. How this trend extrapolates to higher ages and other generations needs to be determined in future work. It is notable that in Figure 3, the values for participants aged 14 and 20 are uncertain and cannot be generalized, as there are only three and one participants in these age groups, respectively.

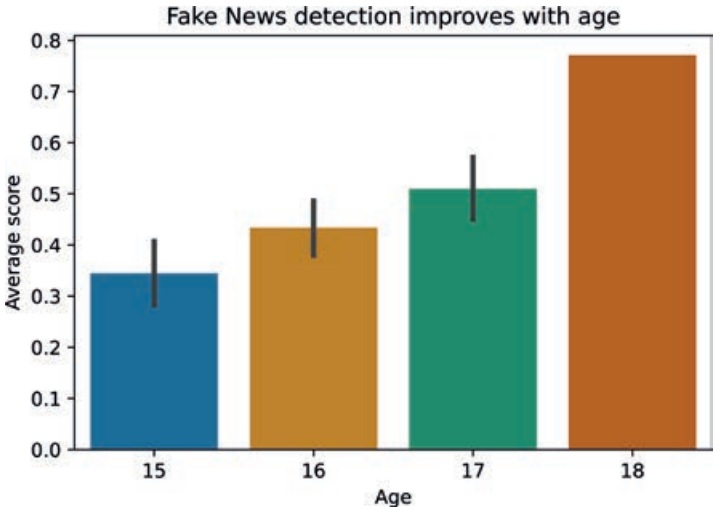


Figure 3: Average score stratified by age.

Nevertheless, differences persist even for classes from the same school and the same grade. A possible explanation for these differences could be the different classroom atmospheres we observed within the experimental sessions. In particular, the concentration of participants differed, as some classes read the articles more diligently and, therefore, needed more time to complete the task. Additionally, students in some classes were more willing to discuss articles and to share results with their seatmates. As these observations are subjective, it is necessary to establish an accurate metric for classroom atmosphere in order to reach a meaningful conclusion in future work.

Characteristics of Low Scoring Articles

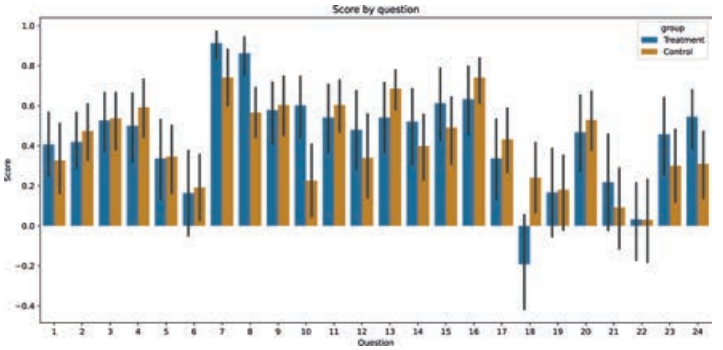


Figure 4: Mean score of treatment and control groups for each article.

Figure 4 shows the mean score of the treatment and control groups across each article. The overall control group mean score of M = 0.44 does not accurately reflect the significant differences in apparent difficulty between questions. In the following section, we examine the commonalities of the five questions which had the most incorrect answers.

The first article, which shows a noticeably low score, was article 6. This article is an opinion piece in the German "Stern" magazine, which we rated as true. This text discusses and criticizes the public broadcasting licensing fee. The mandatory fee is a controversial topic in German public discourse, and it is frequently surrounded by misinformation. The critique commonly comes from groups on the political fringes. We hypothesize that the article is associated with misinformation sources solely based on the topic.

Articles 18, 19, and 21 are a group of articles which also show a lower score than the other articles. All articles share one commonality: They look like they are published by "Spiegel," a generally renowned German news magazine. "Spiegel" is considered to be trustworthy by 57% of Germans (Reuters, 2022). Questions 2 and 14 also feature articles that visually appear to be published by "Spiegel." However, in questions 2 and 18, we asked the participants to evaluate a spoofed article. Spoofing is a technique for

deception, where the origin of an article or the publisher's identity is misrepresented (Innes et al., 2019). Malicious actors recreate the visual look, e.g., a "Spiegel" website, and publish misleading content, leading readers to believe that they are consuming media from the actual magazine. The spoofed articles posed a challenge for participants to identify and made them overall uncertain about articles bearing the Spiegel appearance, whether authentic or fake. This uncertainty indicates that spoofed articles can negatively impact the reputation and trust of a publisher.

Question 18 is noteworthy due to the large mean score difference between control and intervention group (Control Group: 0.096. Intervention Group: -0.229). We suppose that this difference is caused by the design of the feedback. In articles prior to 18, the intervention group had been taught to use information about the publisher to judge an article's credibility. As "Spiegel" is deemed a reliable source, the spoofed article misled the intervention group participants, while the control group students were not misguided by prior interventions. We therefore removed article 18 from the statistical analysis, as the poor performance was caused by the design of the experiment rather than the actual fake news detection ability of the intervention group. Overall, we conclude that spoofed articles pose a significant challenge to appropriate interpretation and can damage a publisher's reputation.

The remaining article that posed a challenge to participants is number 22. This article covers conspiracy theories, which appeared surrounding the Brazilian presidential election in 2022 claiming voter fraud. The article also establishes a connection to supposed election fraud in the US 2020 presidential election, peddling conspiracy theories further. Therefore, we rated this article as fake. Some participants implied that the article wanted solely to report on conspiracies but not to mislead. This shows that it is possible to promote conspiracies by creating the appearance of a legitimate report.

Development of Answering Time

We observed that the mean score of both groups is lower for the last six questions than the previous ones. It is unclear if this is only related to the articles' difficulty or to the experimental design. Furthermore, we observed that the average reading time varies greatly between articles. Our data shows a clear trend of the average time spent on reading the articles decreasing over the progress of our experiment, which can be seen in Figure 5.

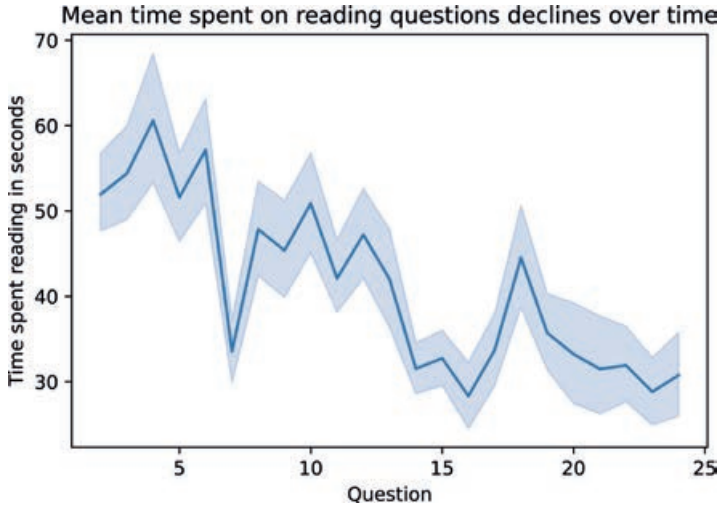


Figure 5: Average reading time for each article over the course of the experimental sessions.

Multiple explanations exist: First, one explanation could be that participants identify fake news more quickly. Based on this assumption, we expect later articles to pose less of a challenge to the participants. However, we rule out this explanation as we still see an imperfect score. Secondly, the students getting used to the user interface could explain part of the decline in reading time. However, given the simplicity of the task and user interface, we deem this hypothesis insufficient for explaining the extent of the effect as well the prolonged decline in reading time after the first questions. Thirdly, we hypothesize that the students rush towards the end of the experimental session as we provide a fixed time frame for answering the questions. Time pressure could have led the students to spend less time on reading the articles in order to complete the whole experiment in time. Lastly, diminishing con-

centration and loss of interest could be the most prominent factor. We assume that the high number of articles as well as the repetitive task structure may have been detrimental to the students' interest towards the end of the experiment. While the exact causes and correlations remain unclear, we hypothesize that the learning outcome could be improved by splitting the experiment into multiple sessions and including short breaks, as suggested in the literature (McGinley, 2011).

One of the main limitations of our work was objectively evaluating the participants' performance. The score for a single question is a value from an ordinal scale (-1 to 1), with a lower score for uncertain or wrong answers. However, the score does not account for the varying levels of difficulty of the questions, as every answer is treated with equal weight. Furthermore, the score method does not account for degrees of uncertainty, when a student answers with the option "rather fake," "don't know," or "rather true." However, we settled with our score calculation method, as it is a simple and intuitive metric. It would be interesting for future work to incorporate different levels of difficulty, or a subjective rating of the difficulty of articles into the scoring method.

Summary and Future Goals

The spread of fake news is becoming an ever-growing problem in our society. In this work, we developed a training web app to strengthen users' fake news detection ability. The application consists of a web application, which presents participants with real and fake articles and asks them to determine their veracity. We conducted an experiment with an intervention and a control group among N = 104 German high school students in grades 10 to 12 during a regular 45 minute school lesson. The experiment itself lasted 20 minutes. The treatment group received feedback cues (e.g., source, reputation of news magazine, etc.) after each article. In contrast, the control group moved on to the following article without feedback. Our analysis showed that our web app significantly improved the feedback group's ability to recognize false articles even within such a short amount of time ($p < 0.003$, $r = .078$). Therefore, we conclude that our intervention, which was based on inoculation theory, is valid for using fake news training in the context of high school education.

Based on our results, we find three areas for further work.

1. Conducting tests with treatment and control groups regularly
   The training could be performed regularly (e.g., bi-monthly). Subsequently, we could analyze whether providing feedback for a larger number of articles leads to a long-term improvement in the treatment group. Tests with the control group should be conducted with the same frequency. Firstly, we can inspect if the control group might improve itself with self-learning. Despite not having constant feedback after answering each question, we presume that the control group's capability or awareness for identifying fake information can still improve by constant reflection during the use of our developed application. Moreover, the collection of time-series data from both groups would further enable evaluation of the app's efficiency.

2. Adapting our custom-developed application for experiments with different target groups
   We could also examine our web app's effectiveness with other target groups. Since the scope of our research is limited to high schoolers in grades 10 to 12 in the area around Munich, we could adjust many variables for future target groups. For instance, we could conduct similar research with younger German high schoolers from different grades or those attending schools in other regions of Germany. Comparative research with senior citizens as the target group could also be profoundly insightful. However, here we would need to further develop our web app to adapt to changes due to the vast difference between the news-consuming methods of the younger and older generation.

3. Improving the feedback cues
   With these first insights into the efficiency of our web app, we can start to optimize the intervention by varying different parameters. Here one could investigate the impact of changing the number of articles in a session, changing the number of the feedback items, or further elaborating on the characteristics of fake news mentioned in the feedback. ■

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Self-reflection

Our Team CheckMate is an interdisciplinary team of 10 students who decided on a project focused on Fake News detection among high school students. We developed a web-based tool and visited high schools in Munich to share our tool with the target audience. This project provided us team members with a valuable opportunity to utilize our diverse skillsets and work together towards a common goal.

One of the strengths of this project was the team's commitment to meeting regularly and discussing next steps. This ensured that everyone was on the same page and contributed to a positive dynamic within the team. However, the team did face some challenges with coordinating the work, especially when team members were abroad or had other commitments. This led to delays and lower quality work at times.

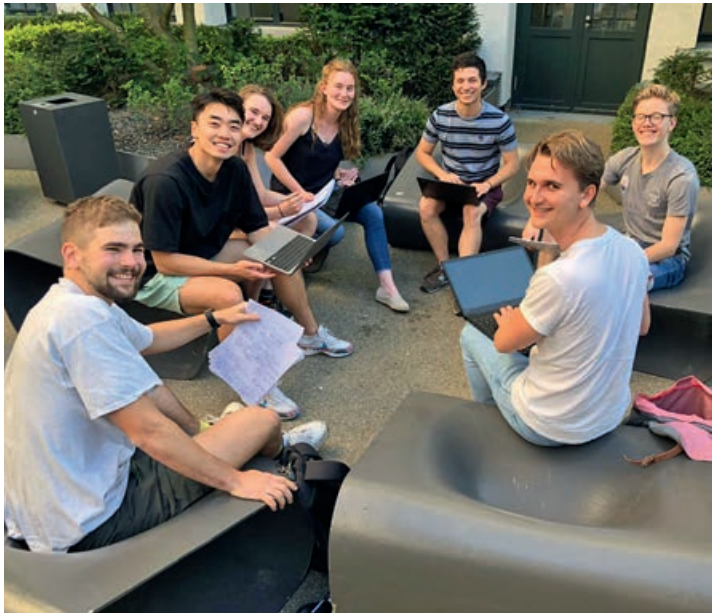
Despite these challenges, we successfully completed the project and were able to promote our tool to high school students in Munich. This not only demonstrated our technical skills but also the ability to effectively communicate and promote our tool to a wider audience.

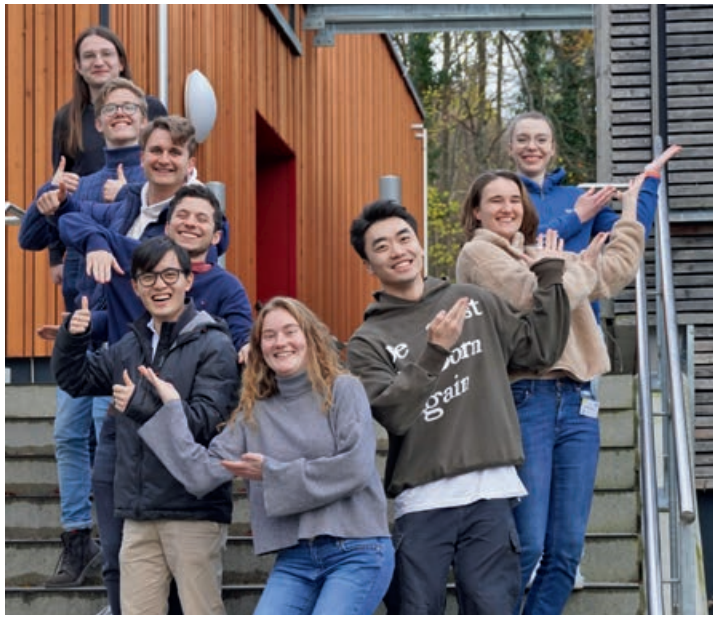
Overall, the CheckMate project was a valuable learning experience for all team members. We developed skills in teamwork, communication, and problem-solving, which will be useful in our future endeavors. Additionally, we learned how to overcome challenges and adapt to changing circumstances, which is an important skill in any professional setting.

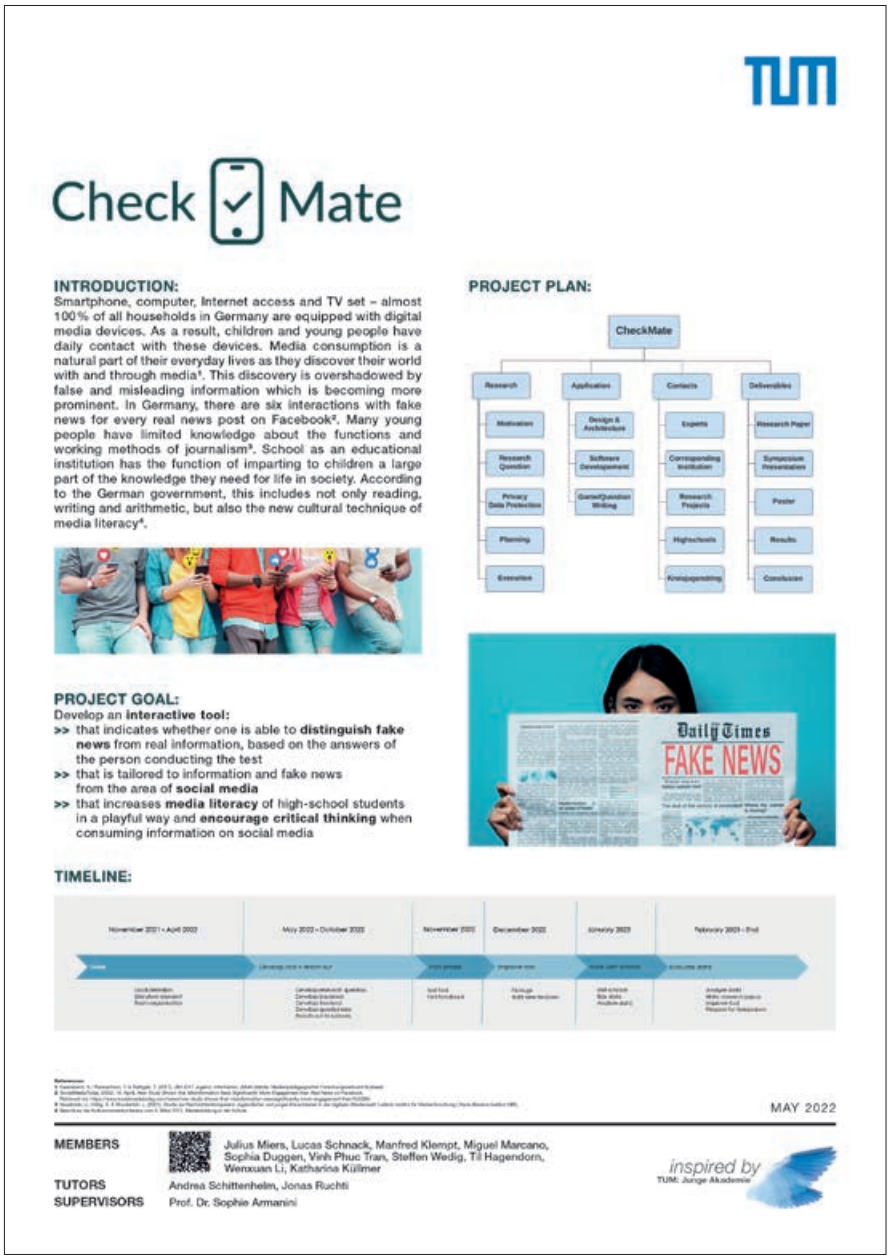
With respect to how the project affected us, the students working on team CheckMate, a major aspect certainly is how it made us ourselves more aware of the dangers associated with fake news. While we were obviously all aware of the issue's general existence, its urgency did surprise most of us. For instance, while collecting the fake news articles to display while presenting the App at the schools, each one of us got a second view of how broadly fake news is distributed via the internet nowadays.

In addition to increasing our knowledge in the area of fake news, we all also benefited from the interaction with all the different stakeholders involved with the project. Be it the school directors and teachers we got in touch with to organize the sessions at the schools or the students themselves – working with people from diverse backgrounds did enrich our skillset in many ways such as finding an adequate communication strategy in interacting with important decision makers to figuring out how to convey a complex message to a younger audience.

Moreover, given the broad scope of the CheckMate App and the long process associated with its development, we also got a lot more experienced in project management. This for instance concerns how to define work packages in a reasonable manner, how to set up alignment meetings in a structured manner and how to come to decisions in a structured way. Overall, each one of us did really take a lot from the time at TUMJA working on the CheckMate project. ■







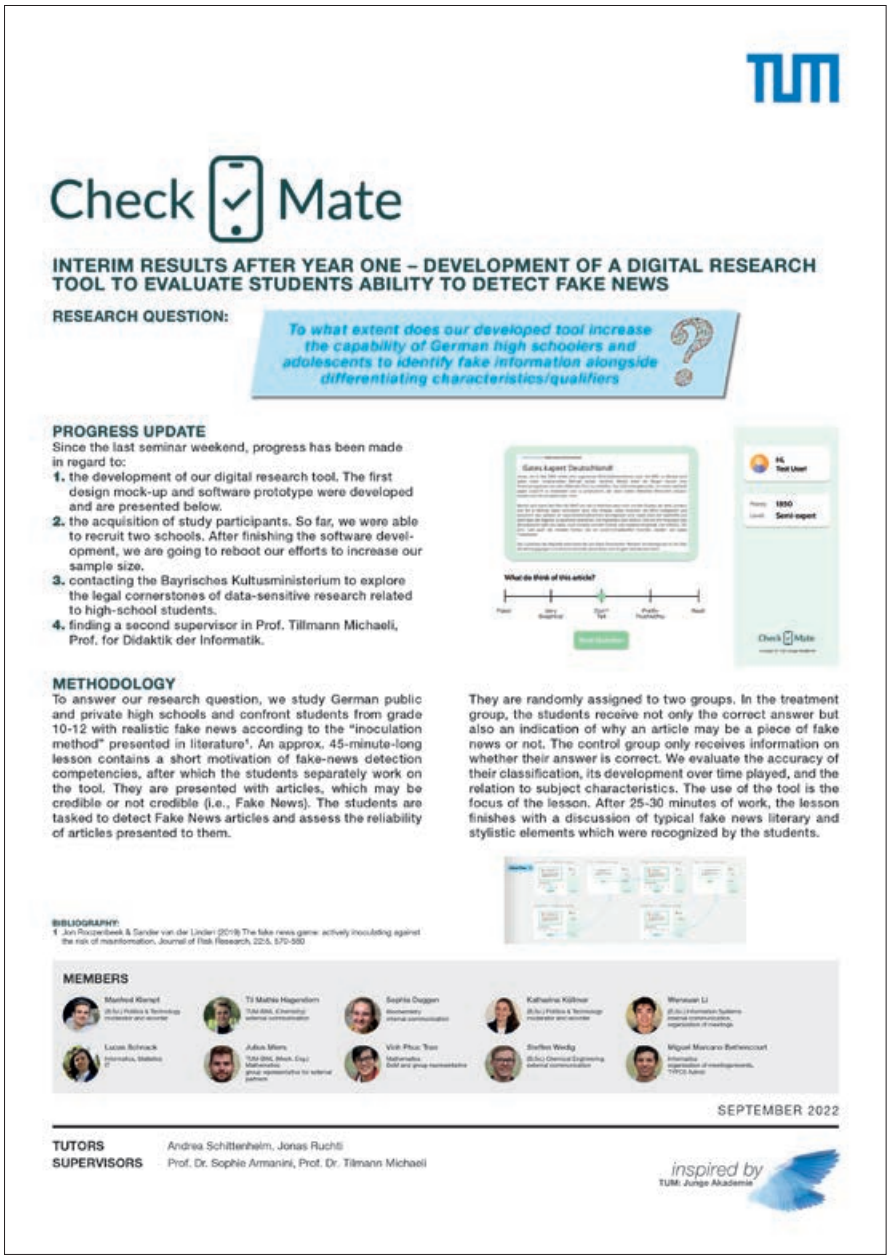
POSTER 1:

Well over half a year after our research group came together, we were finally able to agree on a research area where we saw the potential for a significant impact: Media literacy among high school students.

Did you know that the occurrence of Fake News is increasing? Today, there are already six interactions with Fake News for every reliable post on Facebook. This is a danger considering that in today's world, more and more young people are forming their opinions by consuming social media.

While at the beginning we had planned to explore the phenomenon of swarm intelligence in more detail and accordingly went by the project name “Swarmified,” we had then made the plan to explore the phenomenon of fake news in more detail and to strengthen high school students in recognizing fake news. Project CheckMate was born.

We started with the definition of a project goal. In order to strengthen the recognition of fake news by high school students, we wanted to create an interactive tool that indicates whether one is able to distinguish fake news from real information, based on the person conducting the test, with the effect of increasing media literacy and encouraging critical thinking when consuming information on social media. For the execution of our research project, we accordingly set up a project plan and a corresponding timeline. The big milestone would be our school visits and testing of our tool at the turn of 2022. The focus in the second half of the year was therefore on developing the planned tool and finding suitable partner schools. ■



Check Mate

INTERIM RESULTS AFTER YEAR ONE – DEVELOPMENT OF A DIGITAL RESEARCH TOOL TO EVALUATE STUDENTS ABILITY TO DETECT FAKE NEWS

RESEARCH QUESTION:

To what extent does our developed tool increase the capability of German high schoolers and adolescents to identify fake information alongside differentiating characteristics/qualifiers

PROGRESS UPDATE

Since the last seminar weekend, progress has been made in regard to:

1. the development of our digital research tool. The first design mock-up and software prototype were developed and are presented below.
2. the acquisition of study participants. So far, we were able to recruit two schools. After finishing the software development, we are going to reboot our efforts to increase our sample size.
3. contacting the Bayrisches Kultusministerium to explore the legal cornerstones of data-sensitive research related to high-school students.
4. finding a second supervisor in Prof. Tillmann Michaeli, Prof. for Didaktik der Informatik.

METHODOLOGY

To answer our research question, we study German public and private high schools and confront students from grade 10-12 with realistic fake news according to the "inoculation method" presented in literature[1]. An approx. 45-minute-long lesson contains a short motivation of fake-news detection competencies, after which the students separately work on the tool. They are presented with articles, which may be credible or not credible (i.e., Fake News). The students are tasked to detect Fake News articles and assess the reliability of articles presented to them.

They are randomly assigned to two groups. In the treatment group, the students receive not only the correct answer but also an indication of why an article may be a piece of fake news or not. The control group only receives information on whether their answer is correct. We evaluate the accuracy of their classification, its development over time played, and the relation to subject characteristics. The use of the tool is the focus of the lesson. After 25-30 minutes of work, the lesson finishes with a discussion of typical fake news literary and stylistic elements which were recognized by the students.

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MEMBERS

SEPTEMBER 2022

TUTORS Andrea Schittenhelm, Jonas Ruchti

SUPERVISORS Prof. Dr. Sophie Armanini, Prof. Dr. Tilmann Michaeli

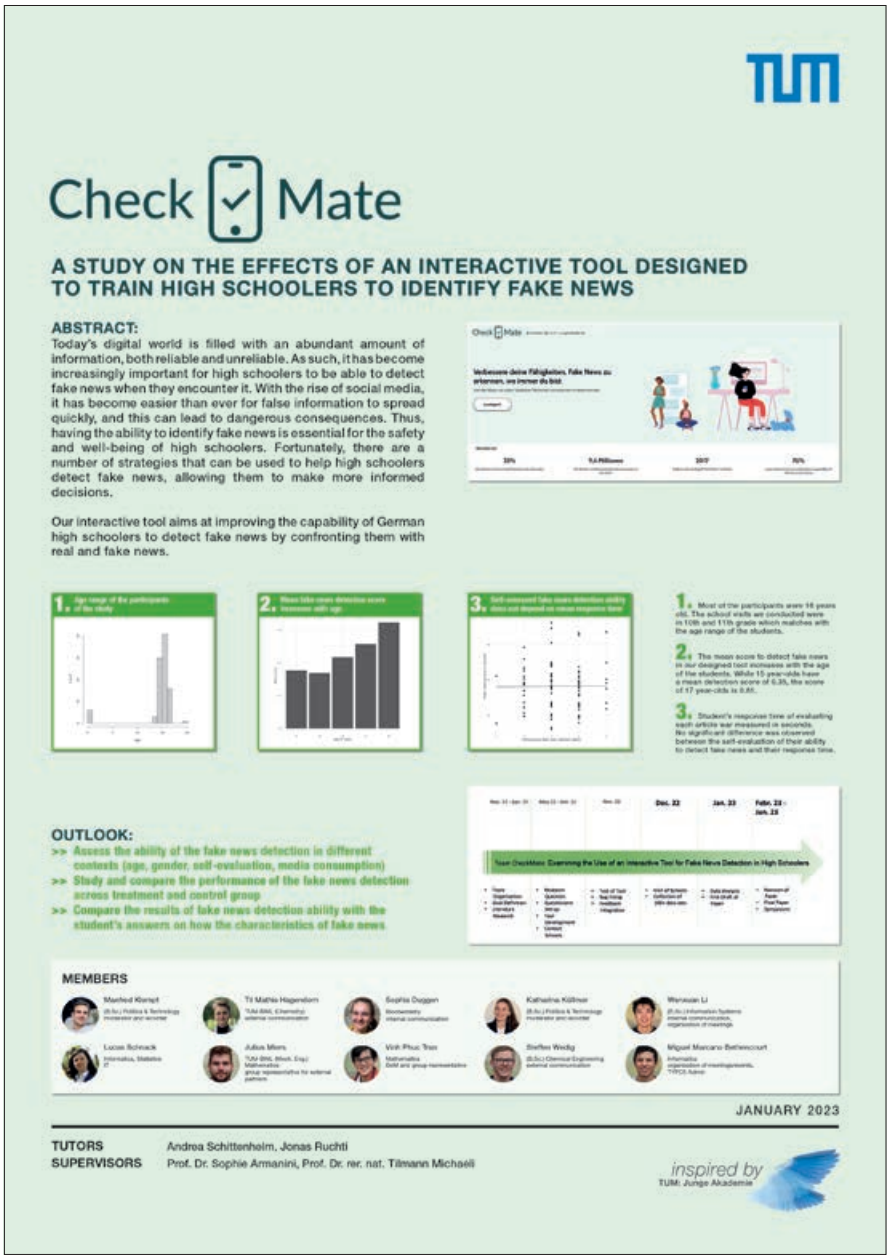
inspired by TUM: Junge Akademie

POSTER 2:

At the weekend seminar at the Starnberger See, it was time to draw an interim conclusion one year after the start of our cohort. After many iterations on the topic of strengthening media literacy among high school students, we finally agreed on the following research question: "To what extent does our developed tool increase the capability of German high schoolers and adolescents to identify fake information alongside differentiating characteristics/qualifiers?"

We had been progressing as planned in our set schedule to answer this research question and achieve our project goal of increasing the capability of Fake News recognition among high school students: on the one hand, we had developed a first design for our mockup as well as a first prototype. On the other hand, we were already able to convince two schools to test our tool. The biggest challenge in acquiring schools for our project was data protection regulations, since we would primarily be processing data from minors. For this, we read deeply into the topic of data protection and also brought Prof. Dr. Tilmann Michaeli, our second supervisor besides Prof. Dr. Sophie F. Armanini, into the team, who supported us with his expertise in the field of didactics and the methodology of our experiment.

It now remained to finalize the last developments on the tool and its design after previous test runs as well as to precisely plan the implementation of the test of our tool on site at the schools. ■



POSTER 3:

After weeks of further developing the software for the web app, collecting fake news articles and annotating these with interventions, we were finally ready for a larger test just before the Seminar weekend at the Ammersee. There, the new scholarship holders of class 23 kindly tested our web app, gave important suggestions for improvement and validated our data collection. We incorporated the feedback and added the final touches to our web app.

At the same time, we planned our school visits. We developed a tripartite lesson structure with an introduction, an experiment and a discussion. We also met with high school teachers to discuss our class visits, explained our research idea to them and answered any questions from their side. After that, everything was set for our experiments. In November and December of 2022, we had four school visits, and 104 students participated in our research project. It was great to conduct the experiment sessions and see so many students using the web app. Many students were very excited about using a digital tool in the classroom and had a lively discussion with us about fake news items and how to discern them online.

With all the data collected, we eagerly anticipated the evaluation of our results. At the Schliersbergalm seminar weekend, we were able to present our first three takeaways and preliminary results. The first results mainly established the relationship between the personal data we collected from students and their score. Only later on were we able to evaluate the impact of the treatment on the ability to differentiate fake news. ■

POSTER 4:

After our trip to the Schliersbergalm, we continued evaluating our results by looking at the impact of the treatment. For each class we visited, we worked out the development of fake news detection ability over the course of our classroom session. There, we found that the intervention group improved progressively compared to the control group. Our idea and intervention worked! Furthermore, we looked at characteristics that were shared by the most difficult to detect articles. For all the results, be sure to check out the scientific part of our report.

After gathering all the results, we began writing our report. We split our text into chapters, which we first worked on individually. In our meetings, we collected feedback on each chapter and iteratively improved our scientific report. Our tutors and supervisors were a huge help in creating the report as well. They gave feedback on our style and content and provided new input.

During the final part of the project, we prepared for the presentation at the symposium. At the seminar weekend in Dachau, we developed the first rough sketch of our talk, and participated in workshops on rhetorical and presentational skills. In the following weeks, we finalized the presentation and wrapped up our project and time at TUMJA. ■