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ABSTRACT	<p>This report presents a quantitative and qualitative assessment of the impact of the AI4T – Artificial Intelligence for and by Teachers – professional learning pathway in France.</p> <p>The first sections introduce the AI4T professional learning pathway, and outline the project’s experimental design, i.e. participant selection and randomisation procedures, theoretical framework used for assessment, and evaluation instruments. This is followed by a description of the sample. Finally, issues pertaining to the experiment’s internal and external validity are addressed.</p> <p>Presentation of the findings is organised in three sections, (i) teachers, (ii) school leaders, and (iii) students. A greater focus is given to the teacher sample as teachers are considered the main target of the AI4T project. After detailing their reactions to the professional learning pathway, the report discusses the three main outcomes of the experiment, namely teachers’ knowledge of AI, their perceptions of AI, and their use of AI. Both the initial state and the impact of the intervention are presented for each outcome. In addition, we provide a discussion of the differential impact of the intervention across teachers. Indeed, differences were found to relate to teachers’ engagement with the MOOC, teachers’ self-efficacy for integrating technology in the classroom, and teachers’ course subjects.</p> <p>A final section highlights takeaways which are likely to inform future AI-based educational policies. The section focuses on the specific needs in terms of professional learning, tool development and ethical safeguards.</p>
KEYWORDS	Artificial intelligence, experimentation, evaluation, impact study, professional learning, teachers

Dissemination level		
PU	Public	X
PP	Restricted to project partner (including the Commission)	
RE	Restricted to a group defined by the consortium (including the Commission)	
CO	Confidential, only for members of the consortium (including the Commission)	

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Introduction

In recent years, the rapid development of new technologies based on Artificial Intelligence (AI) has prompted a crucial discussion of its implications for education. At the European level, the *Digital Education Action Plan 2021-2027* emphasises the need to develop students' AI skills and to provide ethical guidelines on the topic.

Funded by the European Commission, the *Artificial Intelligence for and by Teachers (AI4T)* project was a three-year experiment designed to explore and support the use of AI in education. It consisted in producing, implementing and evaluating professional learning activities in order to familiarise teachers with AI. The project was conducted in 5 countries: France, Slovenia, Italy, Ireland and Luxemburg. 17 partners, including education ministries, evaluators and research centres took part in the project, under the coordination of *France Education International (FEI)*.

The AI4T intervention was built around two online resources developed for the project and common to the five countries: the AI4T MOOC created under the coordination of the *Institut national de recherche en sciences et technologies du numérique* (Inria) and the *AI for Teachers: An Open Textbook* manual written under the coordination of the *Université de Nantes*. Both resources received contributions from the consortium partners. In each country, professional learning pathways were developed, based on common learning objectives but using a variety of formats (e.g. online platforms, webinars, face-to-face sessions).

Following a pilot study conducted in 2021-2022 with a small sample of schools, the intervention was implemented in the 2022-2023 school year. The study focused on maths, science and modern languages teachers with students aged 15 to 17. Half of all participating schools were randomly chosen within each country. In this random school sample, teachers attended the professional learning pathway during the experimentation year. Teachers in the remaining schools constituted a control group and were given access to the AI4T resources after the end of the experiment only.

Data collection methods included surveys administered to teachers, school leaders, and students, and interviews conducted with teachers and school leaders. These findings are complemented with elements from the analysis conducted by a partner of the project, the *Laboratoire lorrain de recherche en informatique et ses applications* (Loria) on teachers' learning traces¹ on the MOOC. Based on the data collected, this report addresses the following four evaluation questions:

- 1) *Was the professional learning experience conducive to teachers' learning of AI?*
- 2) *Was the professional learning experience conducive to changing teachers' perceptions of AI?*
- 3) *Was the professional learning experience conducive to modifying teachers' use or behavioural intentions of using AI?*
- 4) *What are some key factors that can account for the impact of the intervention?*

¹ Learning traces correspond to the digital traces left by users on the MOOC.

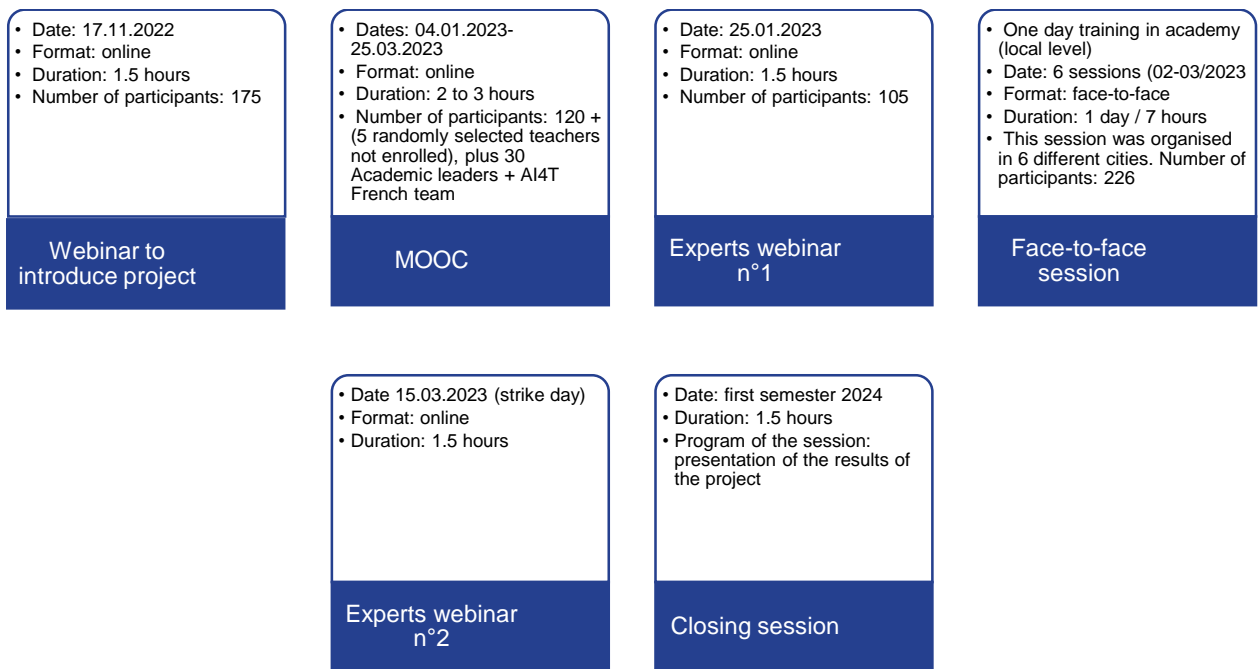
1. Intervention

The AI4T intervention revolved around two common online resources, both translated for all 5 participating countries. The first resource is the AI4T MOOC – Massive open online course – created under the coordination of the Inria. The second resource is a textbook entitled *AI for Teachers: An Open Textbook*, produced under the coordination of the *Université de Nantes*. It was offered as an additional resource for more experienced users and instructors. Finally, a unique set of learning outcomes was defined for the professional learning pathways in all 5 countries:

1. Being able to express one’s understanding and attitude towards AI and discuss it.
2. Being able to understand the basic principles of AI systems.
3. Being aware of AI educational applications and key considerations when identifying, assessing and selecting an AI tool for teaching, learning and assessment.
4. Being aware of legal considerations when using AI in an educational setting.
5. Being aware of ethical considerations when using AI in an educational setting.
6. Being aware of generic AI tools and being able to reflect on their impact on education and critically consider the possibilities for AI tools in education.

In France, the professional learning pathway was implemented from January to March 2023 and followed a hybrid format.

Figure 1 : AI4T professional learning pathway in France



French participants accessed the AI4T MOOC on the French Fun-Campus platform from January to March 2023. During the three months, representatives from the French Ministry of Education and from the MOOC team (INRIA Labs) were available every day to assist teachers via the Fun-Campus forum. The link to the textbook was provided in the MOOC as an additional resource. There were, in addition to the learning materials, two online webinars and one face-to-face session (one per participating local



education authority, also called “académie²” in France). The first webinar featured presentations on AI and learning analytics in the field of education. During the face-to-face session, teachers participated in AI-themed discussions and activities. In these sessions, teachers tested the tool Vittascience aimed at visualising the workings of a deep neural network. They also worked on classroom activities incorporating generative AI. And finally, they reflect on how to best assess ethical concerns involving AI tools prior to using these tools in the classroom. The second webinar was aimed at presenting the textbook.

In both the intervention and control groups, maths teachers also received free access to an AI teaching tool called Kwyk. Kwyk is an online resource consisting of self-correcting maths exercises, corresponding to the French secondary school curriculum. Additionally, it provides teachers with analytical tools to better assess their students’ difficulties.

² In France, the “académie” refers to an educational unit, or local authority, that is based on geographical location, called “region” in French.



2. Experimental design

2.1 Participant selection and sample randomisation

Between May and October 2022, with the help of the French Ministry of Education and 7 local education authorities, 256 volunteer teachers across 120 schools were selected to participate in the project. The sample consisted of 142 maths teachers, 113 English language teachers and 1 teacher from another subject. Participation was initially restricted to high school teachers, but it later came to include lower-secondary education teachers (“enseignants de collèges”) of students in grade 9. In order to participate in the project, teachers had to teach students aged 14 to 17³, whom they had identified at the beginning of the school year, prior to the randomisation process.

The sample is not considered representative of the general population of teachers. However, the Ministry of Education selected different types of schools (i.e. “*lycée général*”, “*lycée professionnel*”, “*lycée polyvalent*” and “*collèges*”⁴) from different geographical areas, including overseas territories.

The evaluation team proceeded with randomly dividing the sample into two groups: an intervention group and a control group. The intervention group had access to the AI4T professional learning pathway during the experimentation year, while the control group was granted access to the online learning resources only at the end of the experimentation year. Randomisation took place after the administering of the baseline questionnaire for teachers. Participants were randomised at the school level. Following the recommendations of Banerjee & Duflo (2017), stratification was employed as the chosen method for randomisation. The evaluation team created strata of 4 schools each. When the number of schools could not be divided by 4, we formed strata of 3 or 2 schools. To determine homogeneity within a stratum, stratification criteria were classified by order of importance. The first criterion, *académie*, was used as a strict randomisation criterion to divide the original sample into sub-samples. The remaining criteria were then used to form strata within each sub-sample to minimise the differences between schools. These criteria included:

- School type
- Index of the school socio-economic dynamics
- Number of volunteer teachers in the school
- Percentage of mathematics teachers among the volunteers
- Percentage of men among the volunteers

While some criteria, such as the *académie* and the number of volunteer teachers in the school, were selected for logistical purposes, others were chosen because they had been identified as having a potential impact on perceptions of and attitudes towards technology, e.g. gender (Poyet, 2015; Badia *et al.*, 2014; Céci, 2019), course subject (Perotta, 2013), and school socio-economic dynamics (Perotta, 2013). School type was included because it was linked to teachers' subject and to the socio-economic dynamics of the school.

Numbers were then randomly generated to select the schools that would be placed in the intervention group. When the stratum contained three schools, the number 1 or 2 was first randomly generated to determine the number of schools in the stratum that would be part of the intervention group. A summary

³ In order to obtain sufficient numbers of participants, teachers of 14-year-old students were added to the participant pool, hence widening the sample beyond the initial focus on teachers of students aged 15 to 17.

⁴These schools correspond to different academic student profiles, so that ‘*lycée général*’ students typically aim for university training, ‘*lycée professionnel*’ students typically aim for vocational types of training, whereas ‘*collèges*’ students are a younger student population, usually aged between 10-15.



table was then created to compare the two groups based on the stratification criteria. Some schools in the intervention group were swapped with schools in the control group when it helped reduce differences between the two groups.

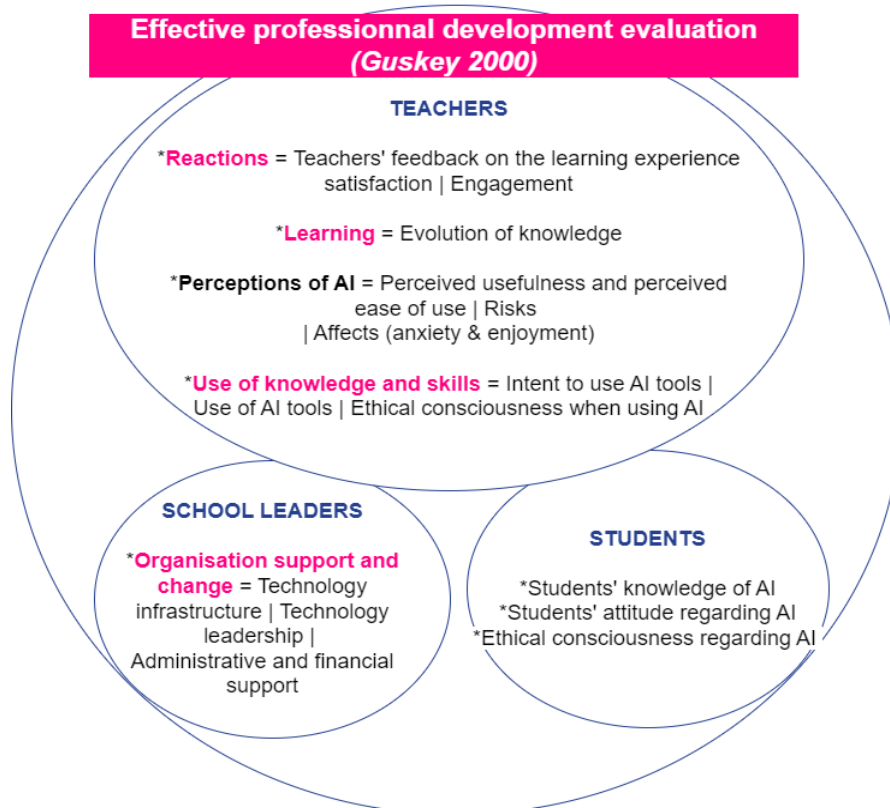
A subset of schools within the intervention group was then selected for the qualitative evaluation. The evaluation team first selected schools where several teachers had already given their consent to participate in recorded interviews, at the beginning of the project. The aim was also to select different schools based on the randomisation criteria.

2.2 Theoretical framework

AI4T started as a pioneer project on AI in education, tackling a relatively unexplored topic. To improve the evaluation questions asked at the beginning of the project, the evaluation team adopted a theoretical framework drawing from various domains of expertise, including AI but also digital technologies and professional development evaluation. Specifically, we drew from Guskey's work as a foundational framework (2000). According to Guskey, the effective evaluation of professional development requires the collection and analysis of five critical levels of information: (1) participants' reactions, (2) participants' learning, (3) organisational support and change, (4) participants' use of new knowledge and skills, and (5) students' learning outcomes.

For each level we created indicators adapted from existing scales and tested them during the pilot phase of the project. Scales were based on the Likert format and generally had 7 answer options for teachers and 5 for students. The response anchors were chosen following the recommendations of Casper *et al.* (2019) to ensure equal intervals between each anchor.

Figure 2: Theoretical framework for the evaluation of the AI4T professional learning pathway



Participants' reactions were assessed by measuring participants' engagement and satisfaction with the professional learning pathway. The **engagement** scale was adapted from Deng *et al.* (2020). The level of engagement with the professional learning pathway was measured using the behavioural, cognitive, social and emotional connections that the participants made with the course content, the instructors and with other learners. Behavioural engagement corresponds to learners' observable actions such as note-taking, while cognitive engagement corresponds to participants' cognitive investment in the learning process. Social engagement refers to both learner-instructor and learner-learner interactions, while emotional engagement centres on emotional connections with the professional learning pathway (enjoyment, interest, etc.). The **satisfaction** scale was adapted from Yenneck (2014). Yenneck identified key dimensions of satisfaction, such as satisfaction with the perceived usefulness of the course, which have an impact on learning benefits and ensuing changes in teaching practice. For both scales, participants were presented with statements and had to answer on a Likert scale from strongly disagree to strongly agree. The answers were then converted into scores from 1 to 7.

The measure of participants' learning was based on the content of the AI4T MOOC and additional reports on AI (European Commission, 2019; Samoili *et al.*, 2020; Fengchun *et al.*, 2021). Experts on AI in education from and outside of the consortium were consulted to review the questions and their interpretation. To measure participants' learning, teachers were asked to assess their own knowledge of AI, indicate their level of familiarity with AI technologies, answer true/false questions on how AI works, and identify tools that contain AI. They were also asked through open questions to give a definition of AI and to name an AI tool that could be used for educational purposes.

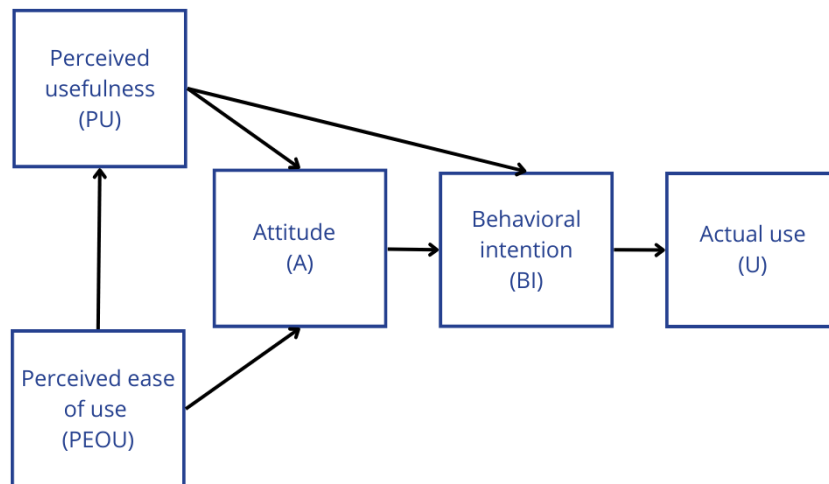
Data on **organisational support and change** were collected through school leaders. Guskey recommends assessing whether the organisation's policies and characteristics are compatible with the implementation of the changes being planned. To address the integration of AI, the evaluation team assessed the technological infrastructure and technology leadership of the schools. Access to technological equipment is sometimes described as the first-order barrier for technology integration, in comparison to the second-order barrier that is teachers' beliefs (Ertmer *et al.*, 2012). A technological infrastructure is a prerequisite for integrating technology into teaching practices. The second variable to be measured, technology leadership, was developed by Anderson and Dexter (2005). In their model of technology leadership, Anderson and Dexter point to several indicators such as school leaders' own use of the technology. They stress the importance of school leaders setting an example by using the technology themselves in order to encourage its use in the whole school. Their indicators also include the number of days school leaders spend on planning, maintaining and administering the technology and the presence of an ethics policy within the school for the use of the technology. The evaluation team used these indicators to assess whether the school context was favourable to AI integration. Because Shattuck (2009) emphasises the importance of school leaders in upholding a vision for integrating technology that aligns with teachers' vision, we also included this factor in our measures. Finally, we assessed the administrative and financial support provided to teachers for their participation in the professional learning pathway.

Given the specific context of the project, which centres on changing teachers' perceptions of AI and encouraging the integration of AI tools in classrooms, another level – **perceptions of AI** – was incorporated to the framework, before **participants' use of knowledge and skills**. This level is based on the Technology Acceptance Model (Davis, 1989), described by Scherer *et al.* (2019, p.4) as follows:

In the literature, the question is repeatedly put forward as to what variables determine technology integration in education. Measuring user acceptance of technology is a way of determining the teacher's intentions toward using new technologies in their educational practice. Over the last decades, a series of models have been proposed to describe the mechanism behind and factors affecting technology adoption. [...] Despite the variety of models, the TAM has dominated the research landscape as the most commonly used model to describe use intentions and actual technology use.



Figure 3 : Technology Acceptance Model developed by Davis *et al.* (1989)



This model identifies two main variables, “perceived ease of use” and “perceived usefulness”, that determine behavioural intention to use and actual use of a technology. The evaluation team adapted the original scale from Davis *et al.* (1989) to measure “perceived ease of use of AI”. To measure the perceived usefulness of AI, we created items specific to the teaching profession, that enabled us to gain information on the specific teaching practices (identified by André Tricot, Cnesco, 2020) for which teachers perceived AI to be the most useful. In order to counter-balance the positive concept of “perceived usefulness”, we also studied participants’ answers on “risks” posed by AI, based on elements identified by Schiff (2021) and Remian (2019).

Some versions of the TAM also include the concept of “attitude”, which definition and scope often varies (Njiku, 2019). We took a particular interest in one of the subdimensions of attitude, namely “affects”. Affects regarding AI are prominent in the AI literature (Wang and Wang, 2019, Cave *et al.*, 2019); they are also of interest to AI4T project partners, and they can further impact the use of technology (Février *et al.*, 2011). We therefore measured AI anxiety by adapting items from the Wang and Wang scale on AI anxiety (2019), and AI enjoyment by generating items based on existing scales on computer enjoyment (Christensen & Knezek, 2009; Noiwan *et al.*, 2005).

Both **behavioural intentions to use AI** and **actual use of AI** were measured, in accordance with the TAM. We also characterised the types of use by asking questions on the frequency of use, on the tools used, and on the tasks performed with the tools. Finally, we measured participants’ ethical consciousness when using AI by using items from a subscale on ethics in the AI literacy scale (Wang *et al.*, 2022).

Due to the characteristics of the AI4T professional learning pathway – objectives, duration and content – and the focus on teachers, we did not measure **student** learning outcomes, but we instead gathered contextual information on students’ knowledge, attitudes and ethical concerns regarding AI. We created an attitude-towards-AI-in-education scale based on the concept of attitude developed by Njiku *et al.* (2019) and on existing scales on attitude towards AI (Suh & Ahn, 2022; Shepman & Rodway, 2020). For the ethical concerns scale, we reviewed existing literature to include the main concerns mentioned in current research on AI in education (Jang *et al.*, 2022; Remian, 2019; Schiff, 2021; Akgun & Greenhow, 2021; European Commission, 2022; Holmes *et al.*, 2021).

2.3 Evaluation instruments

The evaluation of the AI4T intervention is both quantitative and qualitative. Data was collected using questionnaires and interviews. The evaluation also draws on additional materials such as learning analytics provided by the teachers' activity on the MOOC and produced by the Loria. The evaluation protocol and instruments were validated by the *Comité d'éthique de déontologie et d'intégrité scientifique* (CERNI) of the *Université de Nantes*.

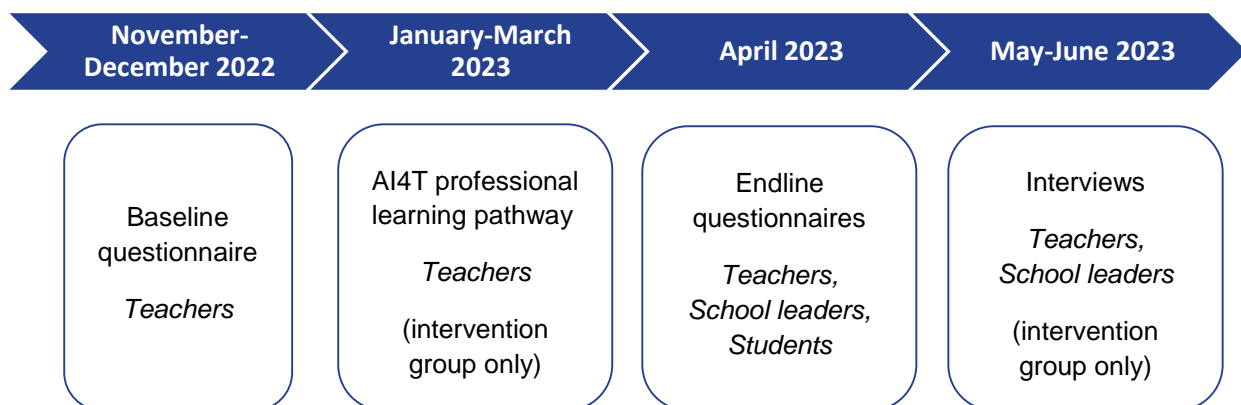
Teachers, students and school leaders were tasked with answering online questionnaires. To measure the impact of the AI4T professional learning pathway on teachers, teacher participants were asked to answer the questionnaire twice – first, at the beginning and then, at the end of the experiment – while school leaders and students answered the questionnaire only once, at the end of the experiment, for contextual information. To administer the questionnaires, the French Ministry for Education sent generic links to teachers' and school leaders' email inboxes. They were also given individual evaluation numbers, required to access the questionnaires. Finally, students completed the questionnaire in class under the supervision of a school staff member. Students from the same class used their teacher's evaluation number.

The teacher questionnaires covered the main outcomes: teachers' knowledge, perceptions and use of AI. In the baseline questionnaire, teachers were asked to provide some basic background information about themselves (e.g. sex, teaching experience, etc.). In the endline questionnaire, teachers who had participated in the intervention were asked questions relating to their engagement and satisfaction with the intervention. The school leader questionnaire was used to provide informational data on the general characteristics and technological infrastructure of the schools, and on the administrative and financial support available for teachers' professional learning and integration of AI in the classroom. Finally, the student surveys addressed students' understanding of AI, attitude towards AI and ethical concerns regarding AI.

Online interviews were conducted with teachers and school leaders from a subset of schools from the intervention group. Interviews took place after completion of the endline questionnaire in order to avoid creating a bias in participants who had either taken part in the interviews or not.

The interviews focused on teachers' experiences with the professional learning activities and the AI tools. They addressed the factors already present in the questionnaires in order to provide a better understanding of participants' answers. Teachers were also asked about their expectations and recommendations regarding AI policies.

Figure 4 : Calendar of the evaluation of the AI4T intervention



Learning traces were collected by the Loria. They correspond to the digital traces left by users of the MOOC (i.e., teachers in the intervention group only). These traces were used to assess users' levels of engagement with the online materials (e.g., via the number of clicks or the consistency in watching video tutorials), and to identify types of learners through cluster analysis. A correspondence table matches the

IDs of the learning traces with the IDs entered in the survey. Thanks to table, the evaluation team studied how engagement with the MOOC modulates the impact of the professional learning activities on teachers' knowledge, perceptions and use of AI. More information on learning traces and analytics can be found in the report *Methodological Framework For Data Collection and Learning Analysis* (deliverable D1.3).



3. Data

3.1 Sample characteristics

The distribution of female and male teachers in the teacher participant sample is relatively even. Compared to the general teacher population, female teachers are slightly under-represented in the present sample, representing 54.4% of participants, compared to 65.6% across French schools (DEPP, 2022). In addition, the sample mostly comprises experienced teachers. The average teaching experience in the sample is 18.5 years⁵. In addition, 55% of the sample consists of maths teachers and 40.6% of modern languages teachers.

The number of students in the sample is estimated at N=956 per school, based on the data collected using school leaders questionnaires. This estimate aligns with the means reported for the general student population in France: 1055 in academic high schools, 406 in vocational high schools and 501 in middle schools (or “collèges”)⁶. The social position index (IPS) represents the socio-economic and cultural conditions of students’ families. The average IPS in the sample is 108 which is slightly superior to the means reported for the general population: 102 for high school students (Le Monde, 2023, 11 January) and 105 for middle school students (DEPP, 2023).

As requested, most teachers (71.7%) selected a 10th grade⁷ class to participate in the experiment. The number of students per class, N=27.2, is representative of the average number of students per class in the general population⁸.

Table 1: Characteristics of the sample

<i>Teachers' profiles</i>		
<i>Sex</i>	Female	54.4%
	Male	43.3%
	Prefer not to say	2.2%
<i>Teaching experience</i>	Average number of years of teaching experience	18.5
<i>Subject taught</i>	Maths	55.0%
	Modern languages	40.6%
	Other	4.4%
<i>Schools characteristics</i>		
<i>School size</i> ⁹	Estimated average number of students	956

⁵ For comparison purposes, 75% of teachers in the sample have more than 12 years of teaching experience, compared to 43% in academic high schools across France (Repères et références statistiques, MENJ, 2022).

⁶ Repères et références statistiques, MENJ, 2022.

⁷ Grade 10 corresponds to “Seconde” in the French educational system.

⁸ For comparison purposes, the average number of students per class in the general population is N=30.7 in academic high schools, N=18.3 in vocational high schools and N=27.7 in lower-secondary schools.

⁹ Due to the data collection method, the average number of students was calculated based on the school leader database. The response rate from school leaders is lower, therefore we can only give an estimate of the average number of students.



<i>Student population</i>	Social position index (mean)	108
<i>School type</i>	Academic	61.7%
	Vocational	11.1%
	Mixed	9.4%
	Lower-secondary	17.8%
Classes characteristics		
<i>Students' year</i>	Grade 9	17.8%
	Grade 10	71.7%
	Grade 11	8.9%
<i>Class size</i>	Average number of students per class	27.2
<i>Proportion of students with academic difficulties</i>	Average proportion of students with academic difficulties per class	35.4%

It must be noted that the teacher sample consists of volunteers. Consequently, teachers in the AI4T project were expected to have a greater interest in digital technologies. Indeed, they proved efficient and successful at integrating technology in the classroom. The average score on this index is 5.5, which falls in the middle of the answer options “generally agree” and “agree” to positive statements associated with their capacity to integrate digital technologies. Furthermore, 35.9% of school leaders stated that their school had participated in other studies related to digital tools in the last 5 years, and 9.4% that their school had participated in other studies related to artificial intelligence in the last 5 years.

The 23 teachers and 5 school leaders who participated in the interviews were also volunteers. Out of the 23 teachers who participated in the interview,

- 9 were women and 14 were men
- 9 were English language teachers and 14 were maths teachers
- 9 were in “lycée general”, 4 in “lycées polyvalents” and 10 in “lycée professionnel”
- 21 taught 10th grade students and 2 taught 11th grade students
- All belonged to the intervention group
- All confirmed having done the MOOC, or at least parts of it
- All had attended the face-to-face sessions and the webinars
- 2 teachers had read the textbook.

3.2 Data processing

Data cleaning

Due to the method of data collection which allowed for multiple answers from a single participant, the first step in the data cleaning process was to remove duplicates, which were identified thanks to participants' evaluation numbers. When a single participant had answered a question several times, the most complete answer was kept and if several answers had been completed to the same extent, the first one was kept. Incomplete answers were kept as long as the participant had completed at least the first pages. For the teacher sample, responses were kept only when the teachers had answered both questionnaires. A report summary of the data cleaning process can be found in [appendix A](#).

Participants' evaluation numbers, which were country-specific, were cross-referenced with the country entered by each participant. Very few students had indicated a country that did not match their

evaluation number. In this case, the country was modified by the evaluator. No discrepancies between assessment number and corresponding country were found in teacher and school leader questionnaires.

Psychometric properties of the scales

Before calculating the scales scores, the scales psychometric properties were tested. The Cronbach alpha was calculated on all scales as a measure of internal consistency. For each item, the evaluation team calculated the item-total correlation and the *alpha if item is dropped*. Items were taken out of the scale when their correlation with the total was significantly lower than the other items and when their removal improved the alpha. A factor analysis was then conducted for each scale. We used Cattell's scree test to identify the number of factors. Additional items were taken out when we identified cross-loadings on several factors. A summary of the psychometric properties of the scales can be found in [appendix B](#).

To calculate the scores, the Likert scales were converted into numbers. The scores on each item were added together and then divided by the number of items. Standardisation was operated at the country level based on the mean and standard deviation of the control group in the baseline.

Balancing checks & attrition

Before conducting the impact analysis, the evaluation team checked that randomisation had produced two comparable groups. To do this, we performed a student t-test on teacher characteristics and on the main outcomes measured at the beginning of the experiment. Significant differences between the two groups are likely in small samples such as the present one. They do not invalidate the randomisation process but they reinforce the importance of considering control variables in the regression analyses. There were significant differences for only two control variables (sex; student academic difficulties) and two outcomes (identification as AI of tools mainly based on AI; intention to use AI). The results of these analyses can be found in [appendix C](#).

The comparability of the two groups is also dependent on attrition throughout the experiment. A difference in response rates between the two groups could lead to both observable and unobservable differences. Table 2 presents the response rates for each group.

Table 2: Response rates for each participant type

	Control group	Intervention group
Teachers' response rate	69.6%	71.5%
<i>(answered both questionnaires)</i>		
School leaders' response rate	57.4%	48.3%
Classes' response rate	16%	24.6%

For teachers, attrition is around 30%. The difference in attrition between the two groups is small (less than 2%). These figures confirm the comparability of the two groups.

The response rate is low for the school leaders questionnaire and very low for the student questionnaire. A discussion with the French Ministry of Education revealed that the sampling process was, for the most part, done directly with teachers. School leaders' low response rate may be due to a lesser engagement with the project. The low response rate of classes may be due to logistical difficulties in administering the questionnaire in class at the end of the school year.

Compliance

In the endline questionnaire (administered in March 2023), teachers were asked whether they had received access to the AI4T intervention. The results show that randomisation was successful, with only 5% of teachers not in their originally assigned group.

Further details are provided on their actual engagement with the professional learning pathway in the section [Completion and Engagement](#).

Processing of qualitative data

Interviews with teachers and school leaders were implemented via Microsoft Teams. Participants provided their consent to be both interviewed and recorded. The NVivo software was used to transcribe the recordings. Each recording was then edited for errors.

The research team created two analysis grids, one for the teachers' interviews and another for the school leaders' interviews. This was done to ensure the comparability of the interview data across participating countries. The grids were informed by the research objectives, the theoretical framework and the interview question grids. They were tested on a small sample of interviews and amended when necessary.

Using the NVivo software, each transcript was then individually proofed, assigning labels (or "codes") to each chunk of data (see [appendix D](#) for an example).

Finally, a summary of each interview was saved in an Excel document. That information was used to illustrate, support, explain, as well as shed some new light on the questionnaire data.

Open questions were also treated as qualitative data. Analytical grids were jointly devised with the other evaluation teams.

4. Teachers' results

4.1 Teachers' reactions to the professional learning pathway

Expectations

In the endline questionnaire used at the end of the experiment, teachers were asked about their **expectations from the professional learning pathway** through interviews and an open-ended question. Many interviewees expressed their initial enthusiasm to participate in a professional learning pathway on AI and made reference to today's society in which AI is widely talked about, including in schools:

Teacher 0517_2 – interview excerpt: *We've been hearing a lot about artificial intelligence lately, so it came at the right time.*

Teacher 0523 – interview excerpt: *I was very excited to participate in this experiment since I also teach computer science, the new subject "NSI" [Numérique et sciences informatiques]. So, I was excited about the interest in artificial intelligence.*

When answering the open question on their expectations, **53.8%** of teachers mentioned that they **expected help on how to use AI tools**. Teachers wrote that they wanted to “discover”, “familiarise themselves with” or “test out” new AI tools. Many of them insisted on the need for “practical” help with “examples of use”. They wrote that they wanted AI tools that would be “directly usable in the classroom”.

40.7% of teachers mentioned that they expected to **learn more about AI**, and that they wanted to “discover AI” or “better grasp what AI truly is”. Many answers mentioned learning about AI for educational purposes more specifically. They wanted to learn about the “challenges” and the “benefits” of using AI in education. A few teachers wrote that they expected to learn about technical aspects, such as “how AI works”. Feedback from the interviews illustrate these two main expectations:

Teacher 0608_1 – interview excerpt: *It seemed interesting to me, not because I wanted to learn new things, but because I wanted to know how I could be guided, and how I could successfully find ideas for my teaching practice, and how I could use specific tools.*

Teacher 0530_2 – interview excerpt: *Actually, the idea was to go and get some new information that I was far from possessing. Artificial intelligence for me wasn't really something very clear in my mind. I had some idea of what it was, but you know, I didn't really see any application in our line of work.*

Teachers were then **asked whether the professional learning pathway had met their expectations**. **8.8%** of teachers answered “completely”, **36.3%** “for the most part”, **48.4%** “a little” and **5.5%** “not at all”. Elements to explain these results are provided in the section on [Satisfaction](#).

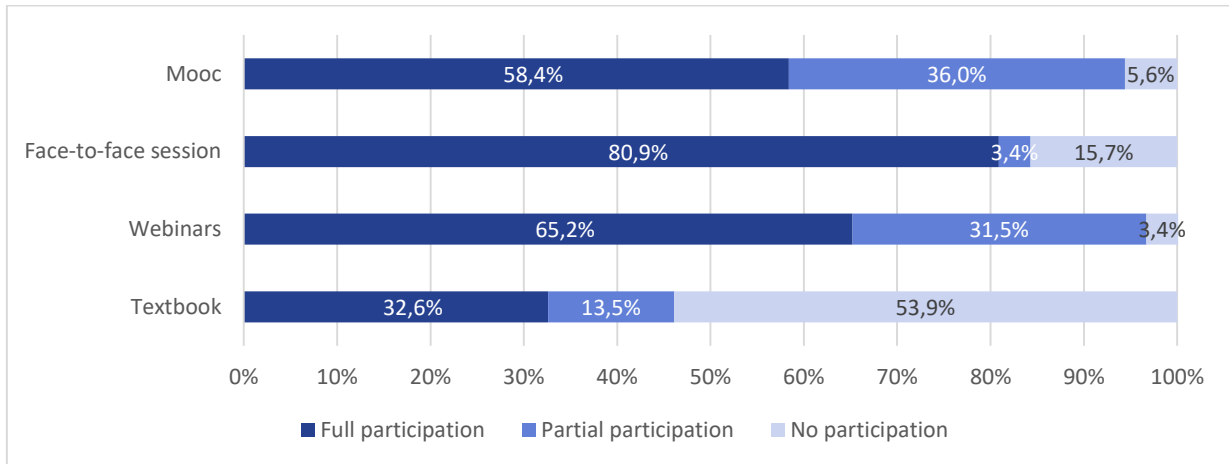
Completion and engagement

Most teachers took part in the MOOC, webinars and face-to-face sessions. 94.5% of teachers claimed that they had, at least partially, completed the MOOC, and 58.5% that they had fully completed it. Regarding the other parts of the pathway, 96.7% of teachers said that they had, at least partially, attended the webinars, and 80.9% that they had fully participated in the face-to-face session. However, only 45.1% of teachers stated that they had, at least partially, read the textbook. It is worth noting that the textbook was not a compulsory element of the French professional learning pathway. Consequently, there was limited emphasis on the textbook during the project's initial stages. Its access was provided via a link in the MOOC and it was described as an additional resource. A webinar to present the textbook was organised mid-March, only a week before the last evaluation questionnaire. Some interviewees indeed confirmed that they had not heard of the textbook.

Teacher 0524_2 – interview excerpt: *The booklet, it doesn't ring a bell at all. So, well, I don't know what to say about that.*

Teacher 0516_1 – interview excerpt: *It doesn't ring a bell. I must not have looked into it in depth... I might have skimmed through it at some point, but right now, I don't have any recollection of it.*

Figure 5: Participation of teachers from the intervention group in the different parts of the professional learning pathway



Few participants reported issues that might have hindered their participation in the professional learning pathway: only **6.6%** reported a lack of equipment, **11%** reported a lack of room to engage with the online materials, **11%** reported bugs in the online materials, and **3.3%** reported a lack of support from their school.

Participants reported a **medium level of behavioural and cognitive engagement** with an average score respectively of **4.66** and **4.74** (on a scale of 1 to 7). Participants also reported a **low level of social engagement**, with an average score of **3**, and a rather **high level of emotional engagement**, with an average score of **5.55**.

A more detailed analysis of participants' engagement with the MOOC specifically was conducted by the Loria. The Loria identified 79 French teachers who left learning traces on the MOOC and could be linked to a survey response (for comparison purposes, there were 93 teachers in the intervention group). They can be classified into two types of learners. The first type, comprising 39 teachers, had, on average, a high level of completion (0.80) and performance (0.77) and a medium level of engagement (0.51). The second type, comprising 36 teachers, had, on average, a medium-to-low level of completion (0.45), a low level of engagement (0.21) and medium performance (0.59). The 4 remaining users could not be classified in one group or another (outliers).

Satisfaction

In this section, we first present **teachers' general feedback** on the professional learning pathway before turning to teachers' **feedback on each part of the pathway** (i.e., face-to-face session, MOOC, textbook and webinars).

Teachers were asked whether they agreed with statements about the **usefulness of the AI4T professional learning pathway for their work**. Teachers reported on average a score of **4**, which corresponds to the answer **"neither agree nor disagree"**. **51.6%** of teachers agreed that the AI4T professional learning experience **helped them improve their professional skills** and only **30.8%** that **it had great practical value for their work**. General comments made on the professional learning pathway in both interviews and open-ended questions showed that teachers found it **informative** but **not practical enough**. Interviewees were disappointed that some educational tools had been described

too quickly, were not adapted to their needs, or were not GDPR compliant and that not enough time had been spent manipulating the tools.

Teacher 0608_1 – interview excerpt: *We were presented with projects, which were at an embryonic stage and which were not really in place yet and that we couldn't use. [...] But we also saw things that we hadn't seen before, such as tools, etc. But this came a little late in the year. What I would have found more interesting is to have tools right away: "go test this and see what happens". In the end, I found myself using things I was already using.*

Teacher 0523 – interview excerpt: *So, to set the scene, the first webinar, it was in December, and that's when we were introduced to the Kwyk platform and Vocacoach for colleagues teaching English. But then, I started using this platform at the beginning of January, but we had no guidelines. It was more like, figure it out on your own.*

Teacher 0524_3 – interview excerpt: *In terms of tools to share with students and to use every day, or at least tools authorised by the Education Nationale... We talked about ChatGTP, things like that, but it's a bit delicate to use. We haven't really discovered a tool that we can use well, and that is been authorised by everyone yet, I believe.*

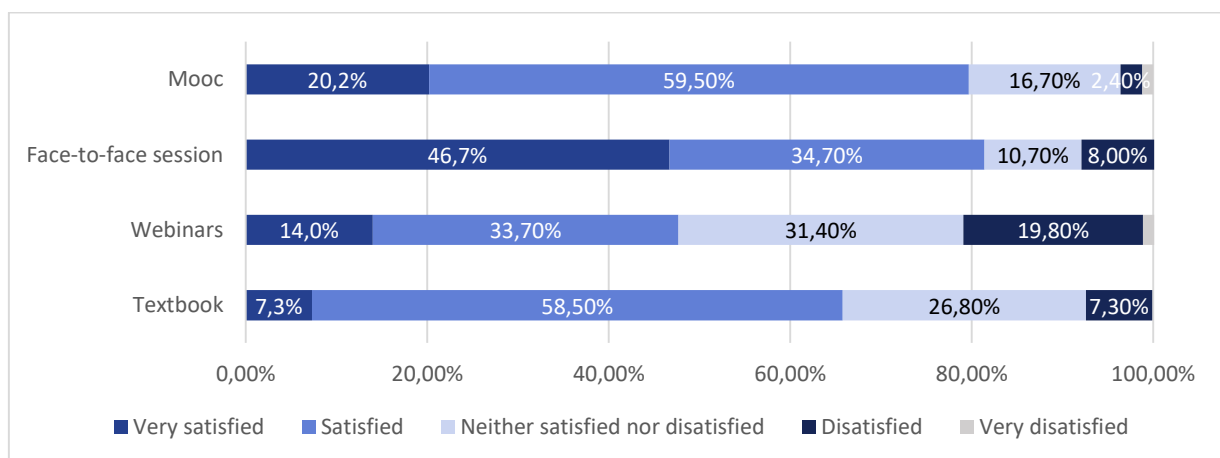
Teacher 0612_2 – interview excerpt: *I fully understand the concept of 'introducing' AI and so on, but at some point, it became too dense and too much information for me. I'm a regular teacher who is concerned with what I'm going to do today in class to reduce differences in levels between students, to encourage self-directed learning in order to meet actual student needs.*

On the topic of satisfaction, teachers were also questioned on their interactions within the professional learning pathway. Teachers seemed to suffer from a **lack interactions with other learners** as **only 47.3%** generally agreed that “the activities and the way the content was taught enabled them to share professional experiences with other trainees”, while they seemed **satisfied with the pedagogical team**. **80%** of teachers at least generally agreed that “**the pedagogical team was very responsive to participants' questions**”. Finally, teachers generally **appreciated the blended-learning approach**.

Teacher 0516_3 – interview excerpt: *I am rather in favor of the blended-learning. [...] I mean, face-to-face has its advantages, but also its disadvantages. And the MOOC allowed me to do things during off-peak time, in my personal time, whenever I wanted, I can take a break, etc. Yes, blended-learning is by far the best thing, that's for sure.*

When looking at the specific parts of the pathway, we observe a difference in satisfaction between the face-to-face sessions and the MOOC for which there were high levels of satisfaction – respectively 80.8% and 79.8% are “satisfied” or “very satisfied” with these elements – and the textbook and the webinars for which lower levels of satisfaction were reported – respectively 64.4% and 46.6%.

Figure 6: Teachers' satisfaction with the professional learning pathway



Answers to open questions revealed that teachers **particularly enjoyed the face-to-face sessions** for the peer-to-peer interactions and interactions with the instructors. According to many interviewees, the face-to-face sessions were also more practical, and better suited to the diversity of teachers' needs, although some participants wished that it had been even more practical.

Teacher 0612_1 – interview excerpt: *The face-to-face session was also nice because it allowed us to meet with colleagues and have a little chat.*

Teacher 0628 – interview excerpt: *So I have a very clear preference for the face-to-face session, it's really what was the most valuable, the most interesting, the most motivating aspect for me. [...] Then, even in the face-to-face session, we didn't do any activities that I could use in the classroom, in my opinion.*

Teachers reported in the open questions that they were **satisfied with the MOOC** because it was “educational”, “interesting” or “very informative”. Many interviewees also enjoyed the flexibility of the format, and only a few participants did not like autonomous online learning. While some participants enjoyed the fun aspect of some of the content, others thought it was too long.

Teacher 0516_2 – interview excerpt: *I found the MOOC interesting [...]. I found it quite fun [...] it was enjoyable and well done.*

Teacher 0516_1 – interview excerpt: *When you train on the online platform, you can do it at your own pace, and look at things several times.*

Teacher 0530_2 – interview excerpt: *Doing a course on a computer... sometimes I struggle. When it's too long, I switch off. And it's also true that in this MOOC, there was a lot of information to take in. So I took it in, but at some points, it was overload.*

Few teachers read the textbook and gave feedback on it. The occasional positive feedback related to the practical examples in the textbook, its structure and the information it contained. Other teachers were disappointed that the textbook was still a work in progress.

Teacher 0623 – interview excerpt: *I read it thoroughly [...]. But there were parts that were marked as 'in progress' where sometimes it suggested that there were worksheets for students. I couldn't access those parts because either they wouldn't load, or they were being finalised, or something like that.*

Finally, **most teachers were dissatisfied with the webinars**. Although some teachers praised the webinars for being informative and for allowing participants to ask questions, others expressed that the webinars were “repetitive”. Teachers also criticised their poor timing and lack of practical use.

Teacher 0517_2 – interview excerpt: *I found the second webinar a bit disappointing actually, because I felt it was just repeating what was in the MOOC.*

Teacher 0522 – interview excerpt: *The webinars were led by people who were AI theoreticians rather than hands-on practitioners having to face students, and who could have given us feedback on how they use AI with students.*

Teacher 0612_1 – interview excerpt: *It was a bit difficult for us, it was often at the end of the school day. First of all, you had to be able to be there. I live far from the school so I have a bit of a journey, it wasn't easy.*

Teacher 0516_1 – interview excerpt: *Having webinars on these topics afterwards allowed us to get some extra information and to ask questions that we had previously made a note of.*

The evaluation team observed that most teachers engaged with all parts of the professional learning pathway, except the textbook which had a lower level of completion. Teachers praised the hybrid format, highlighting their satisfaction with the face-to-face sessions which facilitated interactions and offered practical insights, and also for the MOOC which made self-paced learning possible. They were less satisfied with the webinars, which were deemed repetitive and too theoretical. Despite the face-to-face sessions, there seemed to be a general lack of opportunities for peer-to-peer interactions. Furthermore, the professional learning pathway did not fully meet teachers' expectations. While teachers generally valued the materials for being informative and of high quality, they were disappointed by the lack of practical applications.

4.2 Teachers' learning

Pre-experiment knowledge of AI

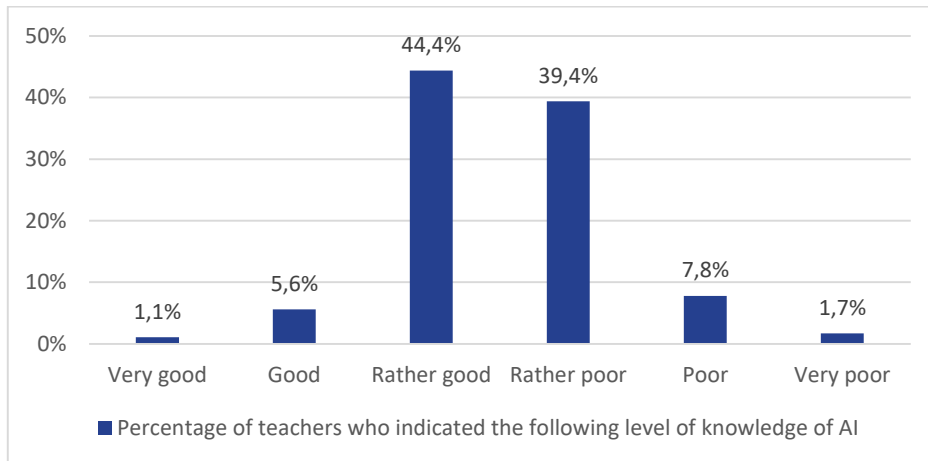
At the beginning of the experiment, teachers were asked to self-assess their knowledge of AI. Most teachers reported a **medium level of knowledge** with **83.8%** of teachers answering "rather poor" or "rather good".

Teachers were also asked to give a definition of AI. Many answers contained notions, such as *AI is a software* (41.7%), or *AI addresses goals* (32.8%). AI-specific properties, such as *AI reasons or imitates human intelligence* (20.6%), or *AI learns* (21.1%) were less frequent. Finally, the least mentioned type of information concerned AI workings, for example, *AI collects data* (6.1%), *AI processes data* (16.7%) and *AI makes decisions* (10.6%). Few teachers provided a detailed answer. Only 16.7% mentioned more than two of the informational elements listed above. Finally, 18.9% of teachers mentioned none of the element above.

Next, we scored on a scale of 1 to 5 teachers' familiarity with various AI technologies, such as "machine learning" and "neural networks". Teachers also tended to report a **low level of familiarity with AI technologies**, with an average score of **2.07**.

Many teachers appeared not to know about real AI tools designed for education. **45.6%** of teachers reported that they **could not give the name of an educational AI tool** and only 12.8% gave the name of a specific tool that qualified as AI. However, **when presented with AI tools and asked to judge (using 3 levels of confidence) whether they believed the tools contained AI, most teachers gave the right answers**. On a scale of 1 to 6, the average score was **4.65**, nearing the level of confidence "quite sure it is true". Teachers were also asked to judge tools that were not primarily AI-based, such as spreadsheets, slideshows, interactive quizzes, and digital workspace. However, due to the fast-changing nature of technology, it was not always possible to identify a right or wrong answer concerning the AI basis in these tools. The baseline questionnaire showed the difficulties in distinguishing regular digital tools from AI tools and therefore in interpreting the results.

Figure 7: Teachers' pre-experiment self-reported level of AI knowledge



Impact

The AI4T professional learning pathway had a significant impact on several variables used to measure teachers' learning. It had a strong effect on

- Their familiarity with AI technologies: **+124% standard deviation.**
- Their confidence in recognising AI in AI tools: **+87% standard deviation,**
- Their self-assessment of AI knowledge: **+60% standard deviation.**

The effect was however non-significant on knowledge of how AI works. It is expected that the impact would be lower on knowledge of how AI works, as it requires a greater level of expertise. The impact on the identification of AI in tools that are not mainly AI-based was also non-significant. As explained previously, changes on this variable would be difficult to interpret due to the difficulty in identifying right and wrong answers. The full results of the regressions, which were conducted to measure the impact of the intervention on each outcome, while controlling for several variables, can be found in table 3.

Table 3: Impact of the intervention on teachers' knowledge

	<i>Self-assessment of knowledge of AI</i>	<i>Knowledge of how AI works</i>	<i>Familiarity with AI technologies</i>	<i>Identification of AI in tools that are mainly based on AI</i>	<i>Identification of AI in tools that are not mainly based on AI</i>
<i>Randomisation</i>	-0.138 (0.128)	-0.217 (0.152)	-0.117 (0.143)	-0.485*** (0.162)	-0.147 (0.142)
<i>Time</i>	0.108 (0.129)	0.213 (0.152)	0.134 (0.143)	0.206 (0.163)	0.044 (0.143)
<i>Gender (1=male)</i>	0.222** (0.105)	0.232* (0.124)	0.324*** (0.116)	0.311** (0.132)	-0.215* (0.116)

<i>Teaching experience</i>	-0.006	-0.012*	-0.007	0.003	0.008
	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)
<i>Subject = modern languages</i>	0.0005	0.439	-0.204	0.405	0.226
	(0.231)	(0.273)	(0.257)	(0.292)	(0.256)
<i>Subject = mathematics</i>	0.079	0.426	0.087	0.067	-0.208
	(0.228)	(0.270)	(0.254)	(0.288)	(0.253)
<i>Type of school = lower-secondary</i>	-0.266**	-0.144	-0.366**	0.023	0.186
	(0.129)	(0.153)	(0.144)	(0.163)	(0.143)
<i>Type of school = other type of school</i>	-0.040	0.005	-0.056	0.172	0.275
	(0.160)	(0.189)	(0.178)	(0.202)	(0.177)
<i>Type of school = vocational</i>	-0.141	0.120	0.008	0.006	0.496***
	(0.166)	(0.196)	(0.185)	(0.210)	(0.184)
<i>Self-efficacy for integrating technology in the classroom</i>	0.377***	0.091	0.384***	0.126**	-0.120**
	(0.049)	(0.058)	(0.055)	(0.062)	(0.055)
<i>IPS</i>	-0.002	0.0003	0.002	0.003	0.004
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
<i>Intervention</i>	0.602***	0.323	1.241***	0.873***	0.320
	(0.180)	(0.213)	(0.201)	(0.228)	(0.199)
<i>Constant</i>	-1.797***	-0.793	-2.205***	-1.459**	0.061

	(0.553)	(0.653)	(0.616)	(0.699)	(0.613)
Obs	352	352	352	352	352
R2	0.263	0.084	0.397	0.160	0.125
Adjusted	0.237	0.051	0.376	0.131	0.094

During the interviews, teachers confirmed that they had gained **theoretical knowledge on AI** thanks to the intervention. Interviewees viewed AI as a complex notion, and stated that the intervention had enabled a greater understanding of AI, had encouraged them to further reflect on AI, and had boosted their confidence in their grasp of the topic. Some also conveyed that their expertise remained limited, and that they still found it challenging to judge whether certain tools incorporated AI.

Teacher 0530_2 – interview excerpt: *Actually, I find it rather positive that this has led me to question myself more than at the beginning. If I question myself, it means that there were elements that have enriched my knowledge.*

Teacher 0517_2 – interview excerpt: *I learnt a bit about how it was built, data stuff... Now, I must admit that there are things that are still too complex. Neural networks... among other things... I don't have my notes with me, I didn't memorise everything, but there are concepts that are a bit more complex to understand. Now, do we really need to understand them... Well, it's part of the tool. Overall, I understood how it works, but not necessarily in much detail.*

Teacher 0608_1 – interview excerpt: *When there were questions like, 'are you sure this contains AI or not?', there were times when I wasn't really sure and that allowed me to become more confident and be able to talk about it, especially during the SNT [Numérique et sciences informatiques] class with my students.*

Teacher 0530_1 – interview excerpt: *Now, we still struggle, even me, I confuse AI with digital tools. The differences aren't always clear.*

Finally, interviewees' answers differed as to whether they acquired any knowledge on the topic of **ethical matters**. Some teachers could not remember whether this topic had been addressed. Others thought that it had not been discussed enough. Whilst others expressed that they had learnt much on the matter.

Teacher 0530_1 – interview excerpt: *No, not enough in my opinion. It seemed to me that instructors' perspective was more about how useful it'd be with our students. This rather left aside the ethical questions that could arise.*

Teacher 0612_1 – interview excerpt: *It was mentioned. That's how I learnt that Duolingo has some shortcomings. Indeed, it is a private tool and there is no formal agreement to date regulating its use with the Education Nationale. [...] It also helped a little in raising awareness concerning the different applications that we think are rather nice but in the end, they capture a lot of things related to our daily lives. It has also caused me to think before using certain applications and downloading them.*

4.3 Teachers' perceptions of AI

Pre-experiment perceptions of AI

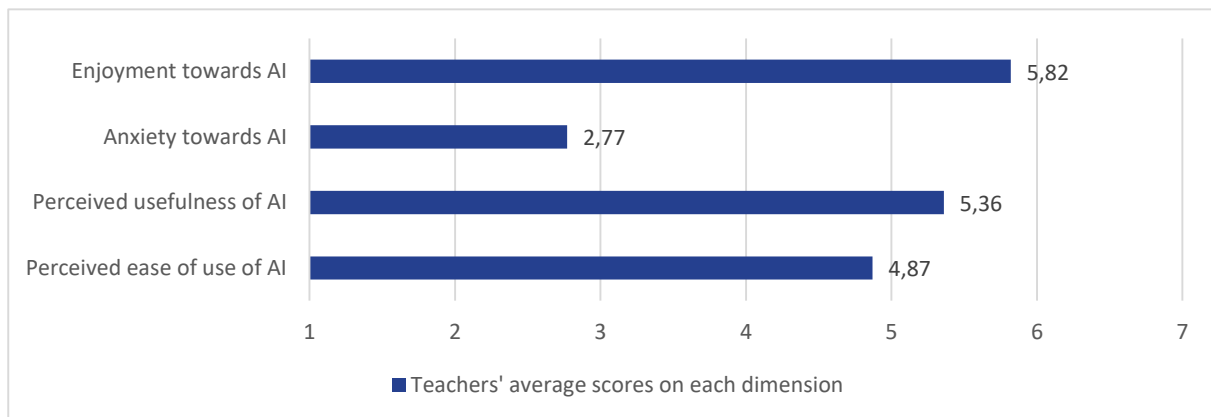
At the beginning of the experiment, we observed a **generally positive attitude towards AI**. Teachers reported a **high level of enjoyment** towards learning about and using AI in their job, averaging **5.82** on a scale where 7 is the highest score. In contrast, their **anxiety** levels towards learning about and using AI in their job were quite **low, averaging at 2.77** on the same scale. Teachers were also asked, in an open question, to list **emotions** that they associated with AI. **41.7%** of teachers mentioned emotions that could be categorised as being **"drawn to AI"**, such as "curiosity", "enthusiasm" and "interest", and

21.7% of teachers associated AI with emotions of **pleasure** such as “ease” and “joy”. On the other hand, **30%** of teachers reported emotions of **apprehension** such as “fear”, “worry” or “mistrust”.

The **perceived usefulness of AI for education** was also **high** among teachers, with an average score of **5.36** on a scale of 1 to 7. Teaching practices for which most teachers agreed that AI would be useful were marking student work (87.2%), monitoring students’ learning and behaviour (87.8%), analysing their errors (87.2%), creating course content (84.4%) and motivating and engaging students (81.7%). They also particularly agreed on the fact that teaching would become more personalised to students’ needs if the use of AI increased in schools (82.2%). Teachers tended to agree with negative statements associated with AI to a lesser extent, yet about half of them agreed that with the adoption of AI in schools, private companies would have a greater influence on schools (57.8%), surveillance in schools would increase (54.4%), and students’ personal data would be more at risk of being breached and used against their best interest (49.4%). Only a small number of teachers agreed that with AI, teachers would be progressively replaced (13.3%), that it would damage the quality of the relationship with students (14.4%), or that education would become dehumanised (20.6%).

Finally, teachers had a **medium to high level of perceived ease of use of AI**, with an average score of **4.87**.

Figure 8: Teachers’ pre-experiment perceptions of AI



Impact

We observed **no significant effect of the intervention on the four variables measured in relation to teachers’ perceptions of AI, i.e. perceived ease of use of AI, anxiety associated with the use of AI and learning about AI, enjoyment associated with the use of AI and learning about AI, and perceived usefulness of AI for education.** It is however interesting to note that there was a significant effect of time on teachers’ perceptions – comparing performance in November and in March. Setting aside potential effects arising from the intervention, **anxiety** towards learning about and using AI by **31%** standard deviation, while **enjoyment dropped** by **35%** standard deviation and **perceived usefulness of AI by 36%**.

Table 4: Impact of the intervention on teachers’ perceptions of AI

	<i>Perceived ease of use of AI</i>	<i>Anxiety associated with use of AI and learning about AI</i>	<i>Enjoyment associated with use of AI and learning about AI</i>	<i>Perceived usefulness of AI for education</i>
<i>Randomisation</i>	-0.007 (0.153)	0.051 (0.149)	0.018 (0.159)	-0.264* (0.154)
<i>Time</i>	0.300* (0.154)	0.308** (0.149)	-0.353** (0.159)	-0.364** (0.154)
<i>Gender (1=male)</i>	0.255** (0.125)	-0.100 (0.121)	-0.066 (0.129)	-0.004 (0.125)
<i>Teaching experience</i>	-0.026*** (0.006)	0.013** (0.006)	-0.009 (0.007)	-0.001 (0.006)
<i>Subject = modern languages</i>	0.413 (0.276)	0.377 (0.268)	0.379 (0.286)	0.321 (0.277)
<i>Subject = mathematics</i>	0.388 (0.272)	0.077 (0.264)	0.188 (0.282)	0.101 (0.273)
<i>Type of school = lower-secondary</i>	-0.107 (0.154)	0.044 (0.150)	0.125 (0.160)	-0.042 (0.155)
<i>Type of school = other type of school</i>	-0.034 (0.191)	-0.094 (0.185)	0.316 (0.198)	0.180 (0.191)
<i>Type of school = vocational</i>	-0.027 (0.198)	0.324* (0.193)	0.244 (0.205)	-0.083 (0.199)
<i>Self-efficacy for integrating technology in the classroom</i>	0.488*** (0.059)	-0.333*** (0.057)	0.332*** (0.061)	0.262*** (0.059)
<i>IPS</i>	-0.001 (0.004)	0.007* (0.004)	-0.004 (0.004)	-0.015*** (0.004)
<i>Intervention</i>	-0.246 (0.215)	-0.187 (0.209)	-0.090 (0.222)	0.173 (0.215)
<i>Constant</i>	-2.491*** (0.660)	0.630 (0.641)	-1.565** (0.683)	0.030 (0.661)



<i>Obs</i>	352	352	352	352
<i>R2</i>	0.238	0.170	0.158	0.152
<i>Adjusted</i>	0.211	0.141	0.129	0.122

In the interviews, many teachers expressed that they were already interested in AI and some stated that participating in the AI4T project had further **increased their level of interest**. Only a few interviewees expressed that they did not yet see what AI could contribute to education. As a result of the professional learning pathway, many teachers were able to **connect specific AI tools to actual teaching practices**. For instance, teachers pointed out the practicality of Twee or ChatGPT for lesson planning, as well as the usefulness of Kwyk to better understand their students with objective data, and they praised Duolingo for engaging features likely to boost students' motivation and engagement. Many teachers highlighted the potential usefulness of AI for personalisation although several teachers mentioned that they had not been able to truly test this function with Kwyk. Some foresaw additional teaching roles that AI could fulfil, even when they weren't aware of specific AI tools providing these services, such as marking and guiding students in selecting subjects and career paths.

Teacher 0623 – interview excerpt: *I went to look at other platforms... I think it's called Twee. It's a platform for teachers. It's the same, you enter your theme, students' level, and then it gives you lots of exercises. It's mind-blowing because I see real interest in it. [...] What I also wish for, and haven't exploited yet, is trying to create personalised pathways through artificial intelligence. I'm not there yet. That's what I would like to do. [...] I think that's where artificial intelligence could really help me manage differences in levels between students.*

Teacher 0608_2 – interview excerpt: *Clearly, yes, there is a time-saving benefit, meaning that before, it took me half an hour to make a spreadsheet to collect data from a table on ranking the ten countries relative to their GDP with different types of information, and when I ask ChatGPT, it does it in thirty seconds.*

Teacher 0524_2 – interview excerpt: *There was a time when I received emails providing an overall analysis of students' work and I thought that was great. In fact, I got reports showing which student had made the most progress, the most deserving student... I used it once with the students, I showed them the results. It's quite funny because students recognised themselves and it's something that is quantified, it's objective. This is not a subjective interpretation. That's the advantage of artificial intelligence. As human beings, we're not always objective in our analyses.*

Teacher 0516_3 – interview excerpt: *I'm thinking of marking maths papers, because that's one of the things that wears me out in my job and which I find takes us away from the number one goal, which is to help someone. When we spend hours marking papers, we are not helping our students. We are doing a task that is required of course, but which could very well be handled by AI on a massive scale. And what's more, AI would do it ten times better than us.*

Interviewees provided a greater diversity of answers to questions relating to their anxiety levels and to their perception of risks associated with AI. Some stated that the professional learning pathway had helped alleviate their fears, while others claimed that it had showed them how some issues could arise with certain tools. Consistent with the results of the questionnaire, the issue of data protection was the one most often mentioned by interviewees, although some of them expressed limited concern on this issue given the general lack of data privacy outside of schools.

Teacher 0516_3 – interview excerpt: *The fact that the training gave me insights allowed me to read through what was being said, and especially to see ChatGPT for myself, and to see that it is not really a source of danger.*

Teacher 0523 – interview excerpt: *There is a crucial problem, which is personal data, so obviously this is an ethical issue. With Kwyk, we had to provide students' names and personal details to register them. So, this is a main problem.*

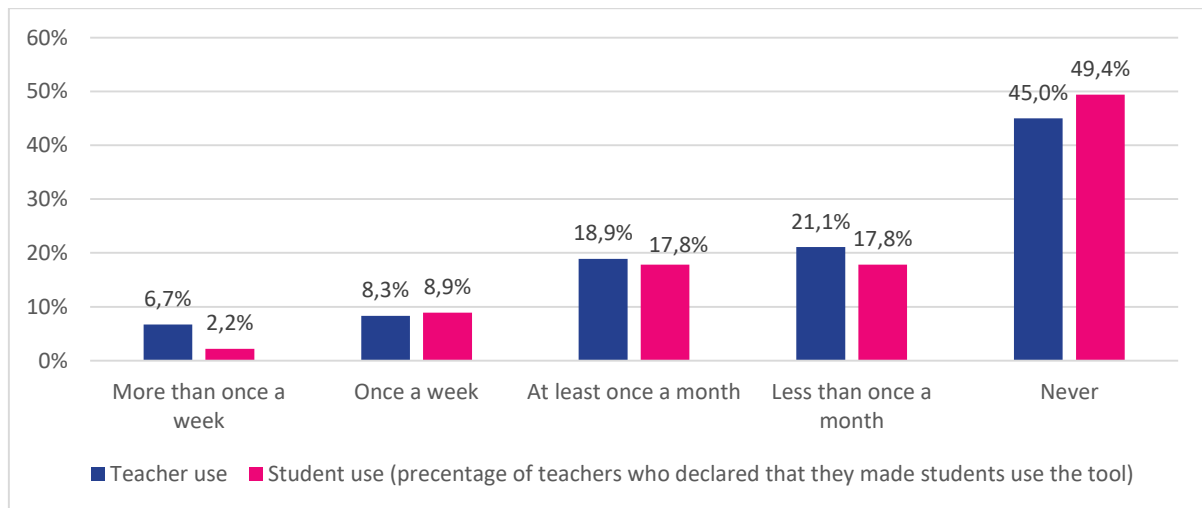
4.4 Teachers' intention to use and actual use of AI

Pre-experiment intention to use and actual use of AI

In November, **45%** of teachers stated that they had **never used educational AI tools** since the beginning of the school year, whereas **15%** had been using them weekly. The results regarding the use of AI with students were sensibly similar, suggesting that the tools available at the time were highly tailored for student use, for example Kwyk or Duolingo.

However, 63% of modern languages teachers used machine translators and more than 80% of teachers used search engines. 79% of teachers who claimed to be using AI tools said that they used them to create, present and share content such as lessons, exercises, homework and tests. Fewer teachers stated using them for marking (38.7%), monitoring students' learning and behaviour (36.3%), or analysing students' errors (21%). Teachers were also questioned on their ethical consciousness when using the tools. They averaged a score of **4.72** on a scale of 1 to 7, indicating a **medium level of ethical consciousness**. 52.4% of teachers agreed that they had a good understanding of ethical issues when using AI tools. Finally, although teachers claimed to make little use of AI, **96.7%** answered "yes" or "probably yes" when asked if they planned on using AI tools during class in the next 5 years.

Figure 9: Teachers' answers concerning their use or their students' use of educational AI tools this year



Impact

Two binary indicators were used to study the measure of AI use. The first indicator distinguishes between use (at least "less than once a month") and no use ("never"), while the second one distinguishes between frequent use (at least "once a week") and non-frequent use (less than "once a week"). Although we see that the intervention has led to a general increase in the "use of AI" and "intention to use AI", it is non-significant at the 5% threshold. The difficulty in achieving this level of significance may be due to the small sample size.

Table 5: Impact of the intervention on teachers' use of AI

	<i>Use of AI</i>	<i>Frequent use of AI</i>	<i>Ethical consciousness when using AI</i>	<i>Intention to use AI</i>	<i>Use of Kwyk</i>	<i>Use of Vitta-sciences</i>	<i>Use of Duolingo</i>
<i>Randomisation</i>	-0.108 (0.131)	-0.056 (0.146)	0.105 (0.171)	-0.358** (0.155)	-0.001 (0.077)	-0.133** (0.061)	-0.033 (0.082)

<i>Time</i>	0.463*** (0.131)	0.134 (0.146)	0.163 (0.157)	-0.154 (0.156)	0.484*** (0.079)	0.023 (0.062)	-0.004 (0.080)
<i>Gender (1=male)</i>	-0.268** (0.106)	-0.233* (0.119)	0.022 (0.129)	-0.143 (0.127)	-0.144** (0.059)	0.035 (0.046)	0.013 (0.079)
<i>Teaching experience</i>	0.003 (0.005)	0.005 (0.006)	-0.011* (0.006)	0.003 (0.006)	0.001 (0.003)	-0.005* (0.003)	0.005 (0.003)
<i>Subject = modern languages</i>	0.473** (0.235)	0.790*** (0.262)	0.106 (0.314)	0.538* (0.280)			0.233* (0.118)
<i>Subject = mathematics</i>	0.088 (0.232)	0.159 (0.259)	-0.265 (0.310)	0.242 (0.276)	0.087 (0.110)	0.101 (0.087)	0.068 (0.380)
<i>Type of school = lower- secondary</i>	0.048 (0.132)	-0.076 (0.147)	-0.395** (0.155)	-0.082 (0.157)	-0.234*** (0.073)	-0.093 (0.058)	0.173* (0.097)
<i>Type of school = other type of school</i>	-0.001 (0.163)	0.110 (0.181)	-0.302 (0.196)	0.368* (0.194)	-0.295*** (0.102)	-0.158* (0.080)	-0.167 (0.102)
<i>Type of school = vocational</i>	0.343** (0.169)	-0.125 (0.189)	-0.143 (0.197)	0.341* (0.201)	-0.161* (0.096)	0.202*** (0.076)	0.307*** (0.116)
<i>Self-efficacy for integrating technology in the classroom</i>	0.057 (0.050)	0.074 (0.056)	0.273*** (0.062)	0.157*** (0.060)	0.016 (0.030)	0.034 (0.024)	0.013 (0.032)
<i>IPS</i>	-0.002 (0.003)	-0.003 (0.004)	-0.002 (0.004)	-0.004 (0.004)	-0.005** (0.002)	0.0005 (0.002)	-0.001 (0.002)
<i>Intervention</i>	0.342* (0.183)	0.186 (0.204)	0.248 (0.222)	0.404* (0.218)	0.165 (0.108)	0.153* (0.085)	0.084 (0.116)
<i>Constant</i>	-0.316 (0.563)	-0.451 (0.627)	-0.860 (0.697)	-0.832 (0.670)	0.671** (0.332)	-0.121 (0.262)	-0.112 (0.347)
<i>Obs</i>	352	352	287	352	211	211	153
<i>R2</i>	0.210	0.151	0.165	0.098	0.419	0.147	0.152
<i>Adjusted</i>	0.182	0.121	0.128	0.066	0.387	0.100	0.079

A few interviewees stated that the professional learning pathway had enabled them to try out new AI tools. The use of AI tools seemed however limited. Maths teachers tended to use Kwyk, but some teachers expressed that they had only used it a few times or that it had been frequently used by a small number of students only. They refrained from using the tool because it would only be accessible during

the experimentation year. There was a bigger problem for modern languages teachers who claimed not to have received full access to the AI tools. As a result, their use was limited to recommending the Duolingo application to a few students or testing Vocacoach once. Teachers also mentioned testing ChatGPT but were limited by ethical issues regarding GDPR compliance.

Teacher 0612_1 – interview excerpt: *But in fact, what was also very nice is that they showed us everything related to ChatGPT via Discord – an application for creating drawings. And it was indeed impressive. I would certainly have used it otherwise, but not as fast as I did.*

Teacher 0516_1 – interview excerpt: *[Kwyk] had real added value. Again, it's always the same, for students who want to keep up. So we're talking about students whose marks are between 8 and 10, who are not very comfortable with mathematics, but who want to hang in there, and progress, and who know that it's important and that they are working for themselves and for their future. It isn't many students, but for these students, some said, it amounted to an extra two to three hours of maths per week as they did the exercises over and over.*

Teacher 0530_2 – interview excerpt: *Yes, I think having access to the Kwyk platform, which helps generate exercises at all high school levels, and to create homework with very interesting learning options, especially the ability to program the number of attempts for completing homework tasks, which in turn allows for some customisation. You can give one or two extra attempts to students who struggle. So I worked a lot on this platform with my students and it was a very positive experience.*

Teacher 0516_2 – interview excerpt: *As I teach maths, we were given a site that you [normally have to pay for] [Kwyk]. Next year, it's quite simple, I can't use this website because I'd have to charge my students. So I'm not going to use it and I'm going to try to find other platforms. The second thing is that they are not adapted to vocational high schools. I will be looking for exercises that correspond to the early middle school curriculum, from sixième [6th grade] to cinquième [7th grade]. I don't really have here exercises that I could give them. So I'm going to use it for small calculations, for introductory notions, but not for a chapter or as other high schools or middle schools might do. It's not a good tool for us.*

Teacher 0612_2 – interview excerpt: *And recently, just at the end of the year, I had a first-year student who told me she was experiencing difficulties. One day, while talking, I told her to try [Duolingo], I heard about it during the training, to see if it could help her. And later, she was proud to tell me 'You know, I've reached 100 consecutive days'. That's great but I didn't know what to do with that... Because I was waiting to be given a tool to test out, as had been mentioned in the training description... it's true that I didn't share it with all my students. And I wasn't able to see what was happening for the two or three students I had suggested it to. Because I thought I was more in the experimentation phase trying out and testing this tool.*

Teacher 0623 – interview excerpt: *[I tested Vocacoach with] one class, but it wasn't really successful because I had to create individual accounts for the students and they were only allowed to go there once. After that, access was blocked. [...] Anyway, I tested it.*

Unlike with the questionnaire where most participants had expressed that they intended to use AI tools, interviewees were more nuanced. They generally stated that either they were **uncertain** whether they would use more AI tools in the future because they could not see the added value of current tools, or that they **intended to use AI** tools in the future, but under specific conditions, for example, tools should be vetted by national institutions first, they should be GDPR-compliant, be free for schools and meet their professional needs.

Teacher 0517_1 – interview excerpt: *For me, it's a lot of preparation work. So I can't tell you today that I'm going to use such and such tool until I've integrated it into a teaching methodology that isn't shaky because using AI just for the sake of using AI is no good.*

Teacher 0516_1 – interview excerpt: *I'm waiting to see the tools that the Education Nationale will make available to me. It's true that I've had the opportunity to use the free platform... But there's no guarantee that we can continue using it, and that I will keep working with it in the future, given the costs for the school.*

Teacher 0614_2 – interview excerpt: *And in that case, it's true that given the possibility, given that our administrator agrees to the new textbooks and possibly to a software like Kwyk, I think this is something I would*



really enjoy using. But we were told we don't have the budget for it. So, unfortunately, we're not feeling very confident.

Teacher 0516_2 – interview excerpt: Well, if there are some [tools] coming, that'd be great. For now, I'm not sure which ones would be best, for now I'm still using the usual software since it's an actual tool. If there's one that is better suited to vocational high school teaching, I'll look into it. But for now, I am not seeing any and no one has shown me any.

Teacher 0608_1 – interview excerpt: If ChatGPT no longer requires a phone number, I can see myself testing it out. I need to see its limitations with younger students, who're under 18. But so long as the terms of use remain as they are, we can't use this tool.

At the beginning of the experiment, teachers had a moderate understanding of AI and lacked familiarity with both technical terms and practical examples of AI tools. The professional learning pathway had a significant impact on their knowledge. Subsequently, teachers grew more confident in their knowledge of AI as well as in identifying AI in digital tools, and they became more familiar with technical terms.

At the beginning of the project, teachers had a positive view of AI. They perceived AI as useful, enjoyable and easy to use, and they reported low levels of anxiety associated with its use. No significant impact of the professional learning pathway was found on teachers' perceptions of AI.

In November, most teachers reported that they either did not use AI or used it rarely, but that they planned on using it in the future. By the end of the experiment, both the intervention and the control groups showed greater AI usage, typically attributed to Kwyk (provided to maths teachers) and also possibly to ChatGPT. However, teachers seemed to only be testing the tools rather than fully incorporate them into their regular teaching practices. Moreover, the assessment team did not report a significant impact of the professional learning pathway on teachers' use of AI. Teachers appeared to have encountered several challenges that prevented them from using AI (e.g. licence fee, non-GDPR compliance, tools not adapted to their needs, etc.). The teachers interviewed at the end of the experiment expressed that they would only consider using AI tools if these challenges were addressed.

4.5 Impact variability

We further explored whether the intervention had the same effect depending on teachers' actual engagement with the MOOC, teachers' course subjects and teachers' self-efficacy for integrating digital technologies in the classroom.

Engagement with the MOOC

An examination of the variables "self-assessment of knowledge of AI", "familiarity with AI technologies" and "identification of AI in tools mainly based on AI" shows a significant effect of the intervention both for teachers with lower and higher levels of engagement with the MOOC. We can see a coherent pattern whereby a greater engagement with the MOOC resulted in greater learning, even though the differences between the two groups were non-significant. When we only took into consideration teachers with a higher level of engagement with the MOOC, we measured a significant effect of the intervention on knowledge of how AI works, corresponding to a **+59% increase in standard deviation**.



Table 6: Impact of the intervention on teachers' knowledge of AI depending on the level of engagement with the MOOC

	<i>Self-assessment of knowledge of AI</i>	<i>Knowledge of how AI works</i>	<i>Familiarity with AI technologies</i>	<i>Identification of AI in tools that are mainly based on AI</i>	<i>Identification of AI in tools that are not mainly based on AI</i>
<i>Randomisation</i>	-0.116	-0.233	-0.164	-0.561***	-0.253*
	(0.136)	(0.160)	(0.144)	0.165	0.149
<i>Time</i>	0.108	0.213	0.134	0.206	0.044
	(0.130)	(0.153)	(0.138)	(0.159)	0.143
<i>Gender (1=male)</i>	0.223**	0.188	0.343***	0.297**	-0.154
	(0.110)	(0.130)	(0.117)	0.134	0.121
<i>Teaching experience</i>	-0.012**	-0.015**	-0.010*	-0.0004	0.012*
	(0.006)	(0.007)	(0.006)	0.007	0.006
<i>Subject = modern languages</i>	-0.015	0.442	-0.223	0.376	0.175
	(0.236)	(0.278)	(0.250)	0.288	0.259
<i>Subject = mathematics</i>	0.110	0.404	0.099	0.075	-0.239
	(0.232)	(0.273)	(0.246)	0.283	0.255
<i>Type of school = lower-secondary</i>	-0.280**	-0.135	-0.395***	0.079	0.217
	(0.138)	(0.163)	(0.146)		0.152
<i>Type of school = other type of school</i>	-0.038	-0.025	-0.184	0.251	0.235
	(0.169)	(0.198)	(0.179)	(0.205)	(0.185)

<i>Type of school = vocational</i>	-0.173	0.113	-0.131	0.081	0.438**
	(0.178)	(0.210)	(0.189)	0.217	0.196
<i>Self-efficacy for integrating technology in the classroom</i>	0.389***	0.090	0.386***	0.141**	-0.130**
	(0.053)	(0.062)	(0.056)	0.064	0.058
<i>IPS</i>	-0.001	0.0005	-0.001	0.005	0.002
	(0.003)	(0.004)	(0.004)	0.004	0.004
<i>Intervention with teachers with a higher level of engagement with the MOOC</i>	0.658***	0.591**	1.485***	1.183***	0.346
	(0.214)	(0.252)	(0.227)	0.261	0.235
<i>Intervention with teachers with a lower level of engagement with the MOOC</i>	0.575***	0.156	1.206***	0.913***	0.399*
	(0.213)	(0.251)	(0.226)	0.259	0.234
<i>Constant</i>	-1.829***	-0.719	-1.812***	-1.669**	0.290
	(0.585)	(0.689)	(0.620)	0.713	0.642
<i>Obs</i>	326	326	326	326	326
<i>R2</i>	0.267	0.093	0.432	0.197	0.114
<i>Adjusted</i>	0.237	0.055	0.409	0.164	0.077

There was no significant effect of the intervention on teachers' perceptions of AI, even when we differentiated teachers relative to their level of engagement with the MOOC.

The effect of the intervention on the usage-related variables also remained non-significant in this analysis, except for the use of Vittascience. A 23% standard deviation increase was reported for the use of Vittascience by maths teachers with a higher level of engagement with the MOOC. During the face-to-face sessions, time was dedicated to testing this tool.

Table 7: Impact of the intervention on teachers' use of AI depending on teachers' level of engagement with the MOOC

	<i>Use of AI</i>	<i>Frequent use of AI</i>	<i>Ethical consciousness when using AI</i>	<i>Intention to use AI</i>	<i>Use of Kwyk</i>	<i>Use of Vittasciences</i>	<i>Use of Duolingo</i>
<i>Randomisation</i>	-0.174 (0.139)	-0.161 (0.151)	0.088 (0.183)	-0.346** (0.161)	-0.037 (0.078)	-0.148** (0.060)	-0.075 (0.088)
<i>Time</i>	0.463*** (0.133)	0.134 (0.145)	0.170 (0.158)	-0.154 (0.155)	0.484*** (0.079)	0.022 (0.061)	-0.003 (0.078)
<i>Gender (1=male)</i>	-0.223** (0.113)	-0.228* (0.123)	-0.032 (0.135)	-0.161 (0.131)	-0.132** (0.061)	0.065 (0.047)	0.060 (0.085)
<i>Years of teaching experience</i>	0.004 (0.006)	0.004 (0.006)	-0.009 (0.007)	-0.003 (0.007)	0.003 (0.004)	-0.005* (0.003)	0.005 (0.004)
<i>Subject = modern languages</i>	0.433* (0.241)	0.710*** (0.262)	0.157 (0.319)	0.526* (0.281)			0.212* (0.119)
<i>Subject = mathematics</i>	0.074 (0.237)	0.130 (0.258)	-0.259 (0.313)	0.260 (0.276)	0.070 (0.110)	0.081 (0.085)	
<i>Type of school = lower-secondary</i>	0.073 (0.141)	0.016 (0.154)	-0.369** (0.164)	-0.056 (0.165)	-0.211*** (0.077)	-0.056 (0.060)	0.173* (0.102)
<i>Type of school = other type of school</i>	-0.015 (0.172)	0.164 (0.187)	-0.370* (0.208)	0.282 (0.201)	-0.245** (0.108)	-0.133 (0.084)	-0.143 (0.103)
<i>Type of school = vocational</i>	0.314* (0.182)	-0.057 (0.198)	-0.123 (0.212)	0.398* (0.212)	-0.117 (0.099)	0.231*** (0.076)	0.268** (0.128)
<i>Self-efficacy for integrating technology in the classroom</i>	0.048 (0.054)	0.063 (0.059)	0.284*** (0.066)	0.161** (0.063)	0.004 (0.032)	0.028 (0.025)	-0.006 (0.035)
<i>IPS</i>	-0.003 (0.004)	-0.003 (0.004)	-0.002 (0.004)	-0.004 (0.004)	-0.004* (0.002)	0.001 (0.002)	-0.001 (0.002)

<i>Intervention with teachers with a higher level of engagement with the MOOC</i>	0.401*	0.431*	0.342	0.424*	0.182	0.234**	0.102
	(0.219)	(0.238)	(0.259)	(0.255)	(0.121)	(0.093)	(0.148)
<i>Intervention with teachers with a lower level of engagement with the MOOC</i>	0.382*	0.202	0.282	0.469*	0.240*	0.095	0.111
	(0.218)	(0.237)	(0.257)	(0.254)	(0.125)	(0.096)	(0.135)
<i>Constant</i>	-0.172	-0.443	-1.029	-0.781	0.584*	-0.148	0.033
	(0.598)	(0.651)	(0.739)	(0.697)	(0.346)	(0.267)	(0.362)
<i>Obs</i>	326	326	264	326	201	201	137
<i>R2</i>	0.199	0.148	0.167	0.100	0.424	0.174	0.156
<i>Adjusted</i>	0.165	0.113	0.123	0.063	0.387	0.121	0.067

Teaching subject

We first analysed whether the variability in teachers' level of engagement with the MOOC depended on their course subject. We found that 50 maths teachers had left learning traces on the MOOC, compared to only 27 modern languages teachers. Maths teachers also had a significantly higher level of engagement with the MOOC, 0.42 for maths teachers compared to 0.30 for modern languages teachers.

The effect of the intervention remained significant for both maths and modern languages teachers on the three types of outcomes where there was an impact in the general sample, i.e. self-assessment of knowledge of AI, familiarity with AI technologies and identification of AI in tools mainly based on AI. We performed significance tests on the differences between the impact of the intervention in the two groups. The analysis did not yield any significant differences between the effects observed in these groups for the knowledge outcomes.

Table 8: Impact of the intervention on teachers' knowledge of AI depending on teachers' subject

	<i>Self-assessment of knowledge of AI</i>	<i>Knowledge of how AI works</i>	<i>Familiarity with AI technologies</i>	<i>Identification of AI in tools that are mainly based on AI</i>	<i>Identification of AI in tools that are not mainly based on AI</i>
<i>Randomisation</i>	-0.135	-0.219	-0.121	-0.486***	-0.149
	(0.129)	(0.152)	(0.143)	0.163	(0.142)
<i>Time</i>	0.108	0.213	0.134	0.206	0.044

	(0.129)	(0.153)	(0.144)	0.163	(0.143)
<i>Gender</i> (1=male)	0.224**	0.238*	0.324***	0.299**	-0.225*
	(0.105)	(0.125)	(0.117)	0.133	(0.117)
<i>Years of teaching experience</i>	-0.006	-0.012*	-0.007	0.003	0.008
	(0.005)	(0.006)	(0.006)	0.007	(0.006)
<i>Subject = modern languages</i>	0.010	0.365	-0.248	0.513	0.302
	(0.264)	(0.312)	(0.294)	0.334	(0.293)
<i>Subject = mathematics</i>	0.042	0.372	0.110	0.206	-0.082
	(0.264)	(0.312)	(0.294)	0.333	(0.292)
<i>Type of school = lower-secondary</i>	-0.265**	-0.144	-0.367**	0.022	0.185
	(0.130)	(0.153)	(0.144)	0.164	(0.143)
<i>Type of school = other type of school</i>	-0.036	0.003	-0.062	0.171	0.272
	(0.160)	(0.189)	(0.178)	0.202	(0.177)
<i>Type of school = vocational</i>	-0.143	0.121	0.011	0.007	0.498***
	(0.167)	(0.197)	(0.185)	0.211	(0.184)
<i>Self-efficacy for integrating technology in the classroom</i>	0.376***	0.092	0.385***	0.125	-0.121**
	(0.050)	(0.059)	(0.055)	0.063	(0.055)
<i>IPS</i>	-0.002	0.0001	0.002	0.003	0.004



	(0.003)	(0.004)	(0.004)	0.004	(0.004)
<i>Intervention with teachers of other subjects</i>	0.534	0.087	1.223**	1.354**	0.721
	(0.517)	(0.611)	(0.575)	0.653	(0.572)
<i>Intervention for with modern languages teachers</i>	0.493**	0.394	1.406***	0.913***	0.412
	(0.226)	(0.267)	(0.251)	0.285	(0.250)
<i>Intervention with maths teachers</i>	0.674***	0.297	1.139***	0.812***	0.232
	(0.200)	(0.236)	(0.223)	0.253	(0.221)
<i>Constant</i>	-1.791***	-0.719	-2.181***	-1.589**	-0.041
	(0.572)	(0.676)	(0.636)	0.722	(0.632)
<i>Obs</i>	352	352	352		352
<i>R2</i>	0.264	0.084	0.400	0.162	0.128
<i>Adjusted</i>	0.234	0.046	0.375	0.128	0.091

As was the case in the general impact analysis, there was no effect of the intervention on teachers' perceptions of AI, neither for maths nor for modern languages teachers.

The evaluation team also measured the effect of the intervention for maths and modern languages teachers separately on the indicators related to the use of AI. We found a significant effect of the intervention on the use of AI for maths teachers only. Participation in the professional learning pathway led to an increase in the use of AI by **45%** of a standard deviation for maths teachers. There is however no significant effect on the use of AI for modern languages teachers. Maths teachers were the only ones to receive new AI tools that they could use in the classroom, potentially accounting for the present contrast between maths and modern languages teachers.

Table 9: Impact of the intervention on teachers' use of AI depending on their course subject

	<i>Use of AI</i>	<i>Frequent use of AI</i>	<i>Ethical consciousness when using AI</i>	<i>Intention to use AI</i>
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<i>Randomisation</i>	-0.100 (0.130)	-0.047 (0.145)	0.117 (0.171)	-0.353** (0.155)
<i>Time</i>	0.463*** (0.131)	0.134 (0.146)	0.173 (0.157)	-0.154 (0.156)
<i>Gender (1=male)</i>	-0.284*** (0.107)	-0.239** (0.119)	0.041 (0.130)	-0.162 (0.127)
<i>Teaching experience</i>	0.003 (0.005)	0.005 (0.006)	-0.011* (0.006)	0.003 (0.006)
<i>Subject = modern languages</i>	0.690** (0.267)	0.925*** (0.298)	-0.119 (0.399)	0.758** (0.319)
<i>Subject = mathematics</i>	0.223 (0.267)	0.178 (0.298)	-0.585 (0.401)	0.424 (0.319)
<i>Type of school = lower-secondary</i>	0.049 (0.131)	-0.074 (0.146)	-0.396** (0.154)	-0.082 (0.156)
<i>Type of school = other type of school</i>	0.007 (0.162)	0.120 (0.181)	-0.307 (0.196)	0.373* (0.194)
<i>Type of school = vocational</i>	0.339** (0.169)	-0.131 (0.188)	-0.146 (0.197)	0.339* (0.201)
<i>Self-efficacy for integrating technology in the classroom</i>	0.053 (0.050)	0.071 (0.056)	0.276*** (0.062)	0.154** (0.060)
<i>IPS</i>	-0.002 (0.003)	-0.003 (0.004)	-0.003 (0.004)	-0.004 (0.004)

<i>Intervention with teachers of other subjects</i>	0.987*	0.441	-0.433	1.159*
	(0.523)	(0.583)	(0.645)	(0.624)
<i>Intervention with modern languages teachers</i>	0.086	-0.122	0.100	0.249
	(0.228)	(0.255)	(0.267)	(0.273)
<i>Intervention with maths teachers</i>	0.452**	0.359	0.376	0.444*
	(0.202)	(0.226)	(0.243)	(0.242)
<i>Constant</i>	-0.527	-0.558	-0.600	-1.061
	(0.578)	(0.645)	(0.746)	(0.690)
<i>Obs</i>	352	352	287	352
<i>R2</i>	0.220	0.161	0.173	0.103
<i>Adjusted</i>	0.188	0.126	0.130	0.066

Self-efficacy for integrating technology in the classroom

We then looked at the effect of the intervention on two groups – teachers above the median level of self-efficacy for integrating technology in the classroom and teachers under the median. We noticed a general trend whereby teachers who started out with a lower level of self-efficacy for integrating technology showed greater learning, suggesting that the pathway was well-suited to this type of learner. The difference is particularly important with respects to the accurate identification of AI in tools that are mainly based on AI. However, the differences between the two groups across all knowledge indicators did not meet the significance threshold, set at 5%.

Table 10: Impact of the intervention on teachers' knowledge of AI depending on their self-efficacy for integrating technology in the classroom

	<i>Self-assessment of knowledge of AI</i>	<i>Knowledge of how AI works</i>	<i>Familiarity with AI technologies</i>	<i>Identification of AI in tools that are mainly based on AI</i>	<i>Identification of AI in tools that are not mainly based on AI</i>
<i>Randomisation</i>	-0.139	-0.217	-0.117	-0.486	-0.147
	(0.128)	(0.152)	(0.143)	(0.162)	(0.142)
<i>Time</i>	0.108	0.213	0.134	0.206	0.044
	(0.129)	(0.152)	(0.144)	(0.162)	(0.143)

<i>Gender (1=male)</i>	0.222**	0.232*	0.324***	0.312	-0.215*
	(0.105)	(0.124)	(0.117)	(0.132)	(0.116)
<i>Teaching experience</i>	-0.006	-0.013**	-0.007	0.003	0.008
	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)
<i>Subject = modern languages</i>	-0.004	0.437	-0.207	0.397	0.230
	(0.231)	(0.274)	(0.258)	(0.291)	(0.256)
<i>Subject = mathematics</i>	0.073	0.422	0.083	0.054	-0.201
	(0.228)	(0.270)	(0.254)	(0.287)	(0.253)
<i>Type of school = lower-secondary</i>	-0.259**	-0.141	-0.361**	0.037	0.179
	(0.129)	(0.153)	(0.144)	(0.163)	(0.143)
<i>Type of school = other type of school</i>	-0.061	-0.006	-0.070	0.128	0.297*
	(0.161)	(0.190)	(0.179)	(0.202)	(0.178)
<i>Type of school = vocational</i>	-0.140	0.121	0.009	0.008	0.495***
	(0.166)	(0.197)	(0.185)	(0.209)	(0.184)
<i>Self-efficacy for integrating technology in the classroom</i>	0.403***	0.105	0.401***	0.182	-0.148**
	(0.055)	(0.065)	(0.061)	(0.069)	(0.060)
<i>IPS</i>	-0.002	0.001	0.002	0.004	0.004
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
<i>Intervention with teachers with higher self-efficacy for</i>	0.500**	0.270	1.173***	0.658**	0.426*



<i>integrating technology</i>					
	(0.201)	(0.238)	(0.224)	(0.253)	(0.223)
<i>Intervention with teachers with lower self-efficacy for integrating technology</i>	0.729***	0.390	1.324***	1.142***	0.187
	(0.212)	(0.251)	(0.237)	(0.267)	(0.235)
<i>Constant</i>	-1.977***	-0.887	-2.323***	-1.837	0.249
	(0.575)	(0.680)	(0.641)	(0.724)	(0.637)
<i>Obs</i>	352	352	352		352
<i>R2</i>	0.266	0.084	0.398	0.169	0.128
<i>Adjusted</i>	0.237	0.049	0.375	0.137	0.094

As was the case in the general impact analysis, no effect of the intervention on teachers' perceptions of AI was found, even when we differentiated teachers on the basis of their level of self-efficacy for integrating technology in the classroom.

The same analyses were performed on indicators related to use. We found a significant effect of the intervention on the use of Kwyk and Vittascience with maths teachers who displayed higher levels of self-efficacy for integrating technology, while no significant effect was found with teachers with lower self-efficacy. Teachers with higher levels of self-efficacy were able to experiment with the tools, but the intervention was not sufficient for teachers with lower levels of self-efficacy.

Table 11: Impact of the intervention on teachers' use of AI depending on their self-efficacy for integrating technology in the classroom

	<i>Use of AI</i>	<i>Frequent use of AI</i>	<i>Ethical consciousness when using AI</i>	<i>Intention to use AI</i>	<i>Use of Kwyk</i>	<i>Use of Vittasciences</i>	<i>Use of Duolingo</i>
<i>Randomisation</i>	-0.108 (0.131)	-0.056 (0.145)	0.106 (0.171)	-0.358** (0.156)	0.002 (0.077)	-0.131** (0.061)	-0.032 (0.082)
<i>Time</i>	0.463*** (0.131)	0.134 (0.146)	0.164 (0.157)	-0.154 (0.156)	0.483*** (0.079)	0.022 (0.062)	-0.003 (0.080)
<i>Gender (1=male)</i>	-0.268** (0.106)	-0.233** (0.118)	0.022 (0.129)	-0.143 (0.127)	-0.146** (0.058)	0.034 (0.046)	0.010 (0.080)
<i>Teaching experience</i>	0.003 (0.005)	0.005 (0.006)	-0.011* (0.006)	0.003 (0.007)	0.002 (0.003)	-0.005 (0.003)	0.005 (0.003)

<i>Subject = modern languages</i>	0.475** (0.235)	0.796*** (0.262)	0.102 (0.315)	0.540* (0.280)			0.235** (0.119)
<i>Subject = mathematics</i>	0.091 (0.232)	0.168 (0.258)	-0.270 (0.311)	0.245 (0.277)	0.096 (0.109)	0.105 (0.087)	0.066 (0.380)
<i>Type of school = lower-secondary</i>	0.045 (0.132)	-0.086 (0.147)	-0.393** (0.155)	-0.085 (0.157)	-0.242*** (0.073)	-0.096* (0.058)	0.176* (0.097)
<i>Type of school = other type of school</i>	0.009 (0.164)	0.142 (0.182)	-0.311 (0.199)	0.378* (0.195)	-0.281*** (0.101)	-0.152* (0.081)	-0.180* (0.103)
<i>Type of school = vocational</i>	0.343** (0.169)	-0.127 (0.188)	-0.143 (0.197)	0.340* (0.202)	-0.156 (0.096)	0.205*** (0.076)	0.317*** (0.116)
<i>Self-efficacy for integrating technology in the classroom</i>	0.044 (0.056)	0.035 (0.062)	0.282*** (0.071)	0.145** (0.066)	-0.012 (0.033)	0.021 (0.027)	0.025 (0.036)
<i>IPS</i>	-0.002 (0.003)	-0.004 (0.004)	-0.002 (0.004)	-0.004 (0.004)	-0.005*** (0.002)	0.0003 (0.002)	-0.001 (0.002)
<i>Intervention with teachers with higher self-efficacy for integrating technology</i>	0.391* (0.205)	0.337 (0.228)	0.221 (0.246)	0.452* (0.244)	0.263** (0.119)	0.199** (0.094)	0.038 (0.130)
<i>Intervention with teachers with lower self-efficacy for integrating technology</i>	0.280 (0.216)	-0.003 (0.240)	0.281 (0.255)	0.345 (0.257)	0.041 (0.125)	0.094 (0.099)	0.146 (0.141)
<i>Constant</i>	-0.230 (0.586)	-0.185 (0.651)	-0.918 (0.733)	-0.748 (0.697)	0.838** (0.341)	-0.042 (0.271)	-0.208 (0.369)
<i>Obs</i>	352	352	287	352	211	211	153
<i>R2</i>	0.211	0.156	0.165	0.098	0.429	0.153	0.155
<i>Adjusted</i>	0.180	0.124	0.125	0.063	0.395	0.101	0.076



There was a coherent pattern whereby teachers with higher levels of engagement with the MOOC showed greater learning on all variables. For teachers with higher levels of engagement, the evaluation team observed a significant impact of the intervention on teachers' knowledge of how AI works. This result confirms that the intervention provided teachers with technical knowledge of AI.

When differentiating teachers relative to their level of self-efficacy for integrating technology in the classroom, it appeared that teachers with lower self-efficacy tended to display greater learning on all variables. These results suggest that the professional learning pathway was particularly well-suited to these teachers' need to acquire theoretical knowledge.

Despite maths teachers showing higher engagement with the MOOC, we did not observe greater learning in this participant group. Therefore, we cannot draw any firm conclusions as to whether the learning materials were better suited to the needs of this group. However, we saw a significant impact of the intervention on the use of AI with maths teachers exclusively. We also observed a significant impact on the use of Vittascience by maths teachers with high levels of engagement with the MOOC and on the use of both Vittascience and Kwyk by maths teachers with high levels of self-efficacy for integrating technology in the classroom. These results are congruent with our knowledge of the experimental conditions. Maths teachers were given more opportunities to experiment with AI tools, either by being granted free access to Kwyk or by being given time to test Vittascience – a tool which could be used for their course subject – during the face-to-face sessions. These findings show that the intervention did have an effect on AI use but only with teachers who had a high level of engagement with the MOOC or self-efficacy for integrating technology in the classroom and who were presented with real opportunities to test AI tools.



5. School leaders' results

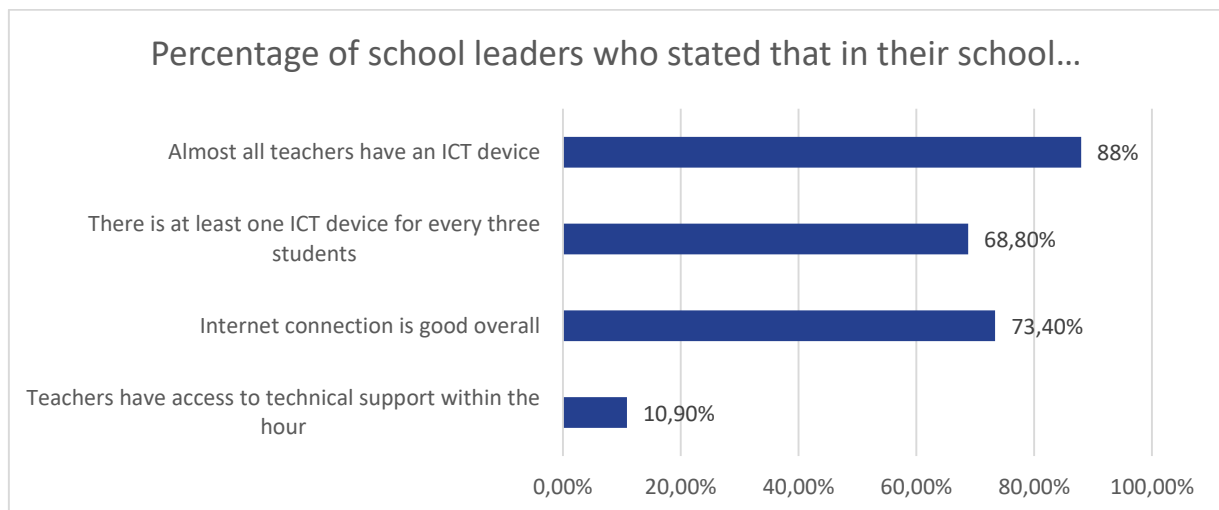
5.1 Schools' technical infrastructure

Overall, school leaders reported a good level of ICT equipment. 68.8% of schools reported at least one ICT device (e.g. laptop, tablet or desktop computer) for every three students. In 96.9% of schools, students have access to ICT devices provided by the school directly in the classroom. 88% of school leaders reported that almost all teachers in their schools are equipped with an ICT device (e.g. desktop computer, tablet or laptop) that they can use in class. Most school leaders (73.4%) also reported that the internet connection in classrooms is good. Although schools were generally well-equipped, feedback from interviews showed that some **practical issues** might still be hindering the use of digital tools in a classroom context.

School Leader 0627 – interview excerpt: *The computer needs charging. The problem is, when you have 35 students, and half of them arrive with a computer with a dead battery, what do you do? It seems silly, but it's not at the scale of a school with close to 2000 students.*

On technical issues, all school leaders reported that teachers had access to ICT support. However, only 10.9% indicated that the support was available within the hour.

Figure 10: School equipment



5.2 Support in place for professional learning

73.4% of school leaders reported that they had **encouraged teachers to take part in the AI4T project**. In schools from the intervention group, **73.8%** also reported that they had **provided teachers with information** about the professional learning pathway. These figures show that some school leaders were actively involved in the participant selection process. However, discussions with the French Ministry of Education suggest that the participant selection process was, for the most part, effected directly with teachers. Information about the project was also not systematically shared with the school leaders, resulting in **weak leadership within the schools** regarding participation in the project. The school leaders who answered the questionnaire and the interviews were likely to be more involved in the AI4T project than other school leaders in the sample. The following excerpt illustrates the case of a school leader who initiated the school's involvement in the project but was not kept informed of its progress.

School Leader 0627 – interview excerpt: *I was immediately interested. I thought, hey, there might be something to explore, tools to bring into our practice, good ideas that can be deployed in schools for students. So, I wanted*

us to apply, and I started to talk to some teachers, and immediately I got a positive response. Let me tell you, the four volunteers we have were amongst the first five or six that I contacted. [...] I found out we were selected in April. Between November and April, we received zero information. Nothing came through. I just had my teachers telling me, well, we had a training session for one day. [...] There should have been an email telling us, listen, you are in the participant sample, you will get this type of information, you will receive this type of training, etc. Had this been the case, I admit, I would have followed the process a bit more closely, I would probably have pushed the teachers a bit more.

50% of school leaders discussed teachers' satisfaction with the professional learning pathway with the teachers themselves, but very few school leaders (**14.3%**) reported that any **time had been devoted to peer-to-peer dissemination**. One school leader also mentioned that the project had not generated any new trends for AI integration because **too few teachers engaged** with the project, or had access to AI tools, or used them and felt satisfied. Another school leader, however, mentioned that he would like to **broaden the scope** of the professional learning pathway to include more teachers the following year.

School Leader 0601 – interview excerpt: *The only satisfactory experience in this regard was that of the maths teacher. So it affected one teacher. So, there was no catalyst or momentum effect that was set in motion.*

School Leader 0530 – interview excerpt: *I would like, for next year, if this project were to continue, to include a lot more staff.*

Teachers who participated in the AI4T project **were not paid** for the hours spent on the project (**76.2%**), **nor was a substitute teacher brought in** when they took part in the professional learning pathway during teaching hours (**69%**). Most school leaders **had no knowledge as to whether teachers' expenses** related to the AI4T experiment were reimbursed (**45.2%**), **and some claimed that teachers had no expenses at all (23.8%)**. These figures are in line with the typical experience of French secondary teachers who take part in professional learning and they did not cause any issue.

School leader 0530 – interview excerpt: *I didn't have to provide anything, and/or set up any special arrangements for them to undertake this training. Everything went smoothly. In fact, they gave us some very positive feedback – they found that participating in this project was not a source of disruption or pressure, and it gave a degree of freedom to the teachers who were involved. So there were no particular issues on that level.*

5.3 AI leadership

School leaders' knowledge and use of AI

School leaders' level of **knowledge of AI** appeared to be slightly lower than that of the teachers who engaged in the AI4T project. 64.1% of school leaders self-assessed their level of knowledge of AI as "rather poor" or lower. 71.9% reported that they could not name an AI tool designed for teaching and learning. 81.2% of school leaders also stated that they did not use AI tools in their work. Feedback from interviews suggests that among the school leaders who used AI tools in their work, ChatGPT was their tool of choice. One school leader mentioned that he had only tried ChatGPT, while another reported using it frequently.

School leader 0601 – interview excerpt: *I use it a lot, quite often, quite frequently, to help me when I write documents. So, it ranges from making a presentation, to producing a summary, to helping me draft an email on a given topic, or a speech, or an internship agreement, or a partnership agreement or association statutes. So yeah, it's a really practical tool for that, because, well, we don't need to reinvent lukewarm water.*

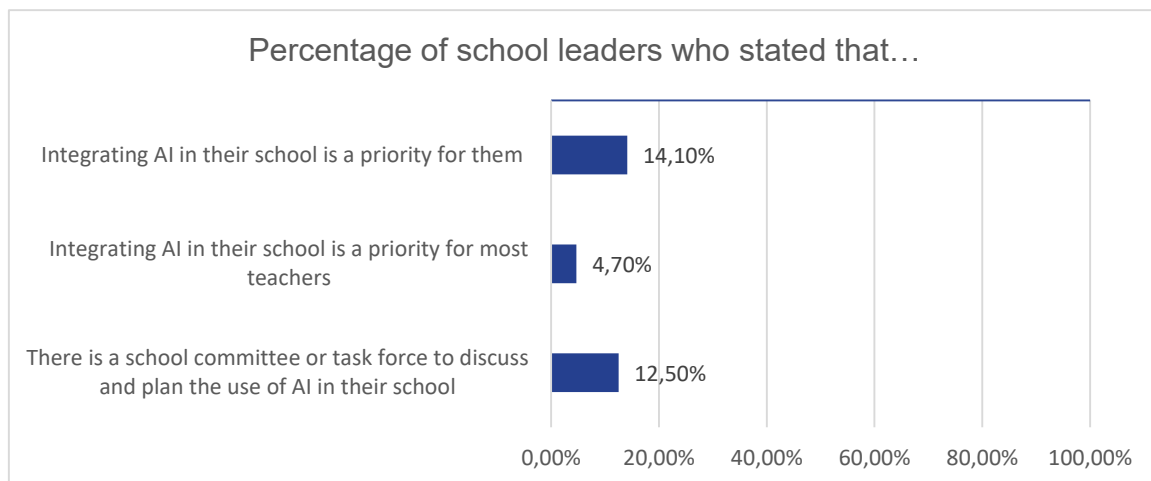
School policy for AI integration

We **observed a general lack of AI leadership across schools**. Only 14.2% of school leaders thought that integrating AI in their school was a priority and 12.5% declared that there was a committee or task force set up to discuss the use of AI. 71.9% of school leaders did not spend any time planning, supporting or administering the use of AI in their school. In addition, **most school leaders (59.4%) had no knowledge as to whether teachers in their school had access to educational AI tools**. When there was a trend in favour of AI integration, it seemed to be led by a small group of teachers. 53.1% of school leaders reported that AI is a priority in their school for “a few teachers only”. Among the 5 school leaders to have been interviewed, three of them mentioned that teachers’ use of AI was a result of personal interest. Only one school leader said that he encouraged teachers to use AI tools. Another school leader stated that the use of digital tools was a priority in the school and that a school committee was dedicated to it, but did not mention any particular policy concerning the use of AI.

School Leader 0525 – interview excerpt: *The first part of the question about whether I want them to use it, personally, I don't have an opinion on that. Same as with digital technology, it's up to each teacher to decide... if I do a digital session, is it... what I question is what the educational effectiveness of AI is. And that's for each teacher to assess with the academic inspector.*

School Leader 0530 – interview excerpt: *Yes, of course, I tell them to use it when I talk about it. First, we have to because students can also use it, so we need to know what it's about. So, they will be encouraged to use it, of course. In any case, it's a part of our society now.*

Figure 11: School policy on AI integration



Although school leaders generally considered that **ethical issues** are important when it comes to the integration of AI in schools – 53.1% asserted that it plays a major role or is the most important factor to consider for AI integration – only 34.4% had shared ethical guidelines regarding AI and data protection with their staff and only 9.4% with students’ parents. AI appears to still be considered a new phenomenon for school leaders and teachers, even if data protection is already being addressed in some schools.

School Leader 0627 – interview excerpt: *[Interviewer: Is AI already a subject of reflection in your institution?] Not at all. Not at all, in fact. I think there aren't many people who fully understand it, even though we hear more and more about ChatGTP, and it's the one that is the most mentioned by teachers. Even though it might not have a good reputation, it's out there and it gets around. Besides these four teachers who are committed to some extent to integrating AI, and besides what we hear in the media or what we might read in some online discussions, I think there aren't many people who are very committed to AI. It's still a bit like science fiction.*

School Leader 0525 – interview excerpt: *We try to direct students and teachers towards tools that are GDPR compliant. Our digital and educational adviser sends out information to the school on a regular basis.*

Data collected from school leaders shows that, overall, schools in the sample have a good technical infrastructure. Therefore, access to equipment is not a significant issue in using AI.

We observed that a few school leaders encouraged teachers to participate in the experiment and provided them with information about it. Teachers did not appear to need any particular support to participate in the pathway as they did not encounter any major difficulty.

However, there seemed to be no actual trend in the schools encouraging the use of AI. Most school leaders did not think that integrating AI in the school was a priority. Further, more than half of them had no knowledge as to whether the teachers in their school had access to educational AI tools.

6. Students' results

6.1 Students' knowledge of AI

When asked whether they knew what artificial intelligence is, **41%** of students reported that they knew “a little” and **37.3%** that they knew “quite a lot”. However, **most students correctly identified** that there was AI in machine translators (80.6% of students), in image-recognition systems (88%) and in search engines (67.1%).

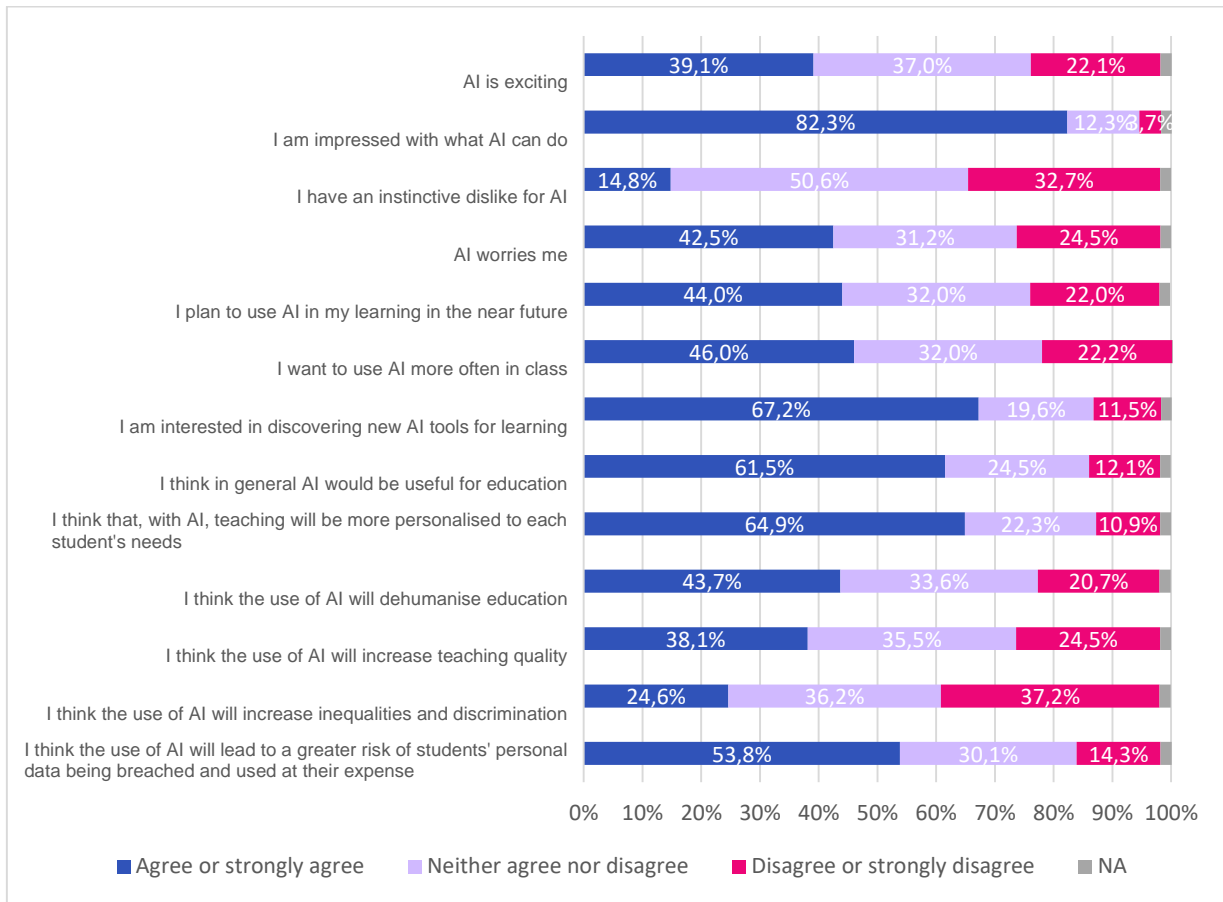
6.2 Students' attitude towards AI

Students' attitude towards AI was measured using positive and negative statements. On average, **students' overall attitude leaned towards neutrality**, although they agreed slightly more with positive statements. On a scale of 1 to 5, the average scores were 3.57 on the positive attitude scale and 3.1 on the negative attitude scale.

Students were generally **impressed** with what AI can do (82.3% agreed or strongly agreed), whereas responses were divided on whether they found AI **exciting**. They were also generally **interested in discovering new AI tools for learning** (67.2%), but only about **half of the students wanted to use AI in the classroom to a greater extent** (46%), or **planned to use AI** for learning in the near future (44%). Finally, they generally considered that AI would be **useful in education** (61.5%) and that AI would help **personalise** teaching to students' needs (64.9%), but they were **divided as to whether this would improve the quality of teaching**.

Students' answers were **divided on negative statements**, e.g. “AI worries me”, “I think the use of AI will dehumanise education”, or “I think the use of AI will increase inequalities and discrimination”, while more than half of the students (53.8%) associated AI with greater risks concerning data privacy.

Figure 12: Students' attitude towards AI

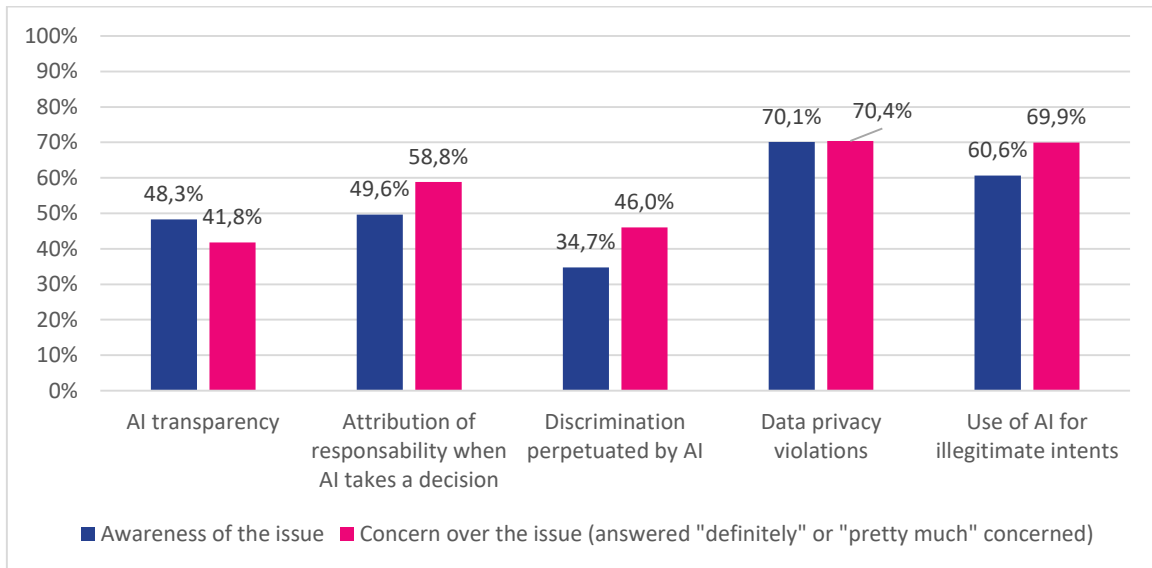


6.3 Students' awareness of ethics and concerns regarding AI

Students were also asked about their **awareness of ethical debates regarding AI**. While most students had heard of issues such as “potential privacy violations due to data collection by AI tools” (70.1%) and “potential use of AI for illegitimate intents” (60.6%), only about half of the students had heard of the debate on AI transparency (48.3%), or on the attribution of responsibility when AI makes decisions for humans (49.6%). The debate on potential discrimination generated by AI was the least known issue (34.7%).

Students were most concerned about **potential violations of privacy** due to data collection by AI, and the potential use of AI for **illegitimate intents**. Regarding these two issues, 70% and 69.9% of students answered that they were “definitely” or “pretty much” concerned respectively. 58.8% were also “definitely” or “pretty much” concerned by the difficulty of attributing responsibility when AI makes decisions for humans.

Figure 13: Students' awareness and concerns regarding ethical issues associated with AI

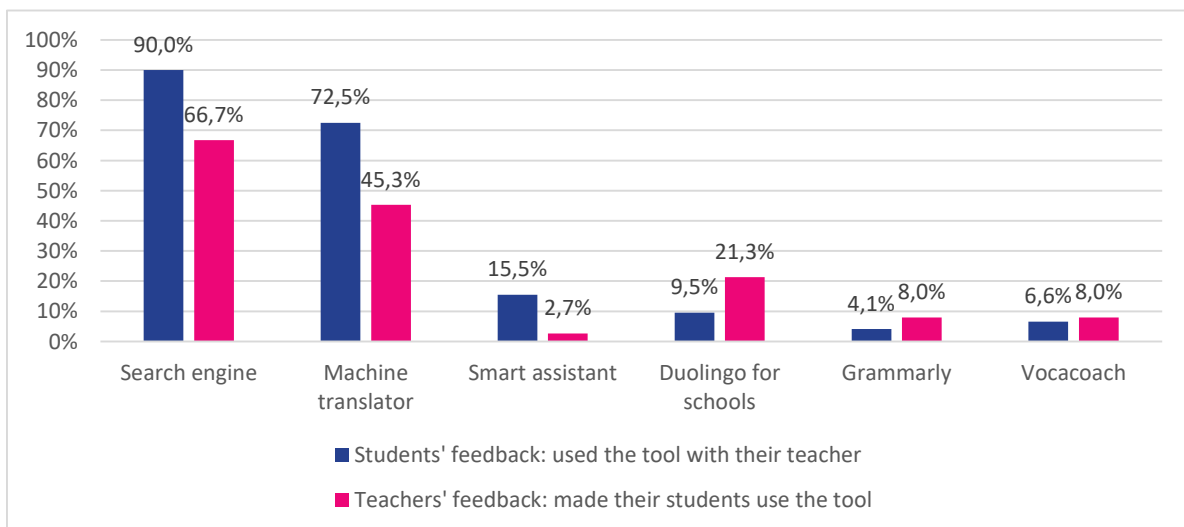


6.4 Students' use of AI

Students' data confirmed teachers' feedback. In April, 87% of students stated that they had used educational AI tools with the teacher involved in the project (compared to 81% of teachers who had stated that they had made their students use educational AI tools). Agreement across answers suggests that students are **aware** that the tools they were presented with contained AI. A consistent pattern is also found with **maths teachers' students** – 62.7% of maths teachers' students said that they had used Kwyk, whilst 60.6% of teachers gave the same response.

Students of modern languages teachers reported a higher use of generic AI tools compared to teachers' claims made at that same time (March). 90% of students stated that they had used search engines with the teacher participating in the experiment, 72.5% had used machine translators and 15.5% smart assistants. In comparison, 66.7% of modern languages teachers claimed that their students had used search engines, 45.3% machine translators and 2.7% smart assistants. The data suggest that students use AI tools to a greater extent than their modern languages teachers expect from them.

Figure 14: Comparison of statements made by modern languages teachers and by students regarding the use of AI tools for the course



Overall, students reported that they had some understanding of what AI is, although nearly half of them claimed that they only had a very limited grasp of the concept.

Most students agreed with positive statements concerning AI, stating that they were impressed with AI or that AI would be useful for educational purposes. On the other hand, almost half of them agreed that AI is a source of concern. In addition, it is worth noting that a significant portion of students, about a third, seemed to have no definite opinion on the usefulness of AI for educational purposes (neither agreeing nor disagreeing).

While most students showed some awareness of issues relating to data privacy and illegitimate uses of AI, they displayed little awareness of other concerns, such as AI transparency, discriminatory practices generated by AI, or the assignment of responsibility when AI makes decisions for humans.

Finally, students' statements concerning the use of AI in the classroom were in agreement with teachers' statements, except when it came to AI tools that were not specific to education, such as machine translators or search engines. Students appeared to use these tools more frequently than they were asked to.



7. Takeaways from teachers and school leaders

7.1 On professional learning about AI

Many teachers and school leaders who participated in the project expressed the **need for AI training**. Some emphasised that AI is a technology of the present day that is actively being used in society, rather than some futuristic innovation, and they stressed the urgency of AI training. They explained that they needed professional assistance to be able to answer students' questions, provide them with guidance and use AI wisely with them. Teachers felt it was important for them to have a good grasp of AI and of issues surrounding AI prior to using the technology with their students.

Teacher 0516_3 – interview excerpt: *I think there are quite a few teachers who, because of ChatGTP, are starting to get scared or want to be trained because they feel it's becoming urgent. The need for training has become pressing.*

Teacher 0530_2 – interview excerpt: *Earlier, you talked about the potential dangers of AI. That's something I think is important to point out to students. But to talk about AI, you need to really understand the subject, and when I talk about a topic, I like to know it inside out and I'm not there with AI. It's not even that I'm not there, it's that I don't know what I'm talking about and I can't imagine bringing this up with students if I don't.*

Teachers' pre-experiment knowledge of AI showed that most teachers who participated in the project already had some understanding of AI but that they were not familiar with the technology behind it. For instance, they found it difficult to say when AI was present in a tool or not. The AI4T professional learning pathway has proven successful in improving teachers' knowledge of AI. Many teachers stated that they had found the resources very informative and some highlighted the quality of the expertise. It would therefore be useful to **make available the learning resources produced during the AI4T project to address teachers' need to better understand AI**.

However, teachers stated that the AI4T resources lacked practicality. While some teachers used MOOC videos as resources to show their students, others emphasised that to pass on the knowledge to their students, they would need **more specific training with a focus on teaching practices**.

Most of all, the AI4T professional learning pathway did not do enough to assist teachers in their use of AI. Teachers' low level of satisfaction with the usefulness of the pathway in their work is testimony to this shortcoming, and there was no measurable impact of the training on the use of AI, except in the case of maths teachers with high levels of self-efficacy for integrating technology in the classroom or with a high level of engagement with the MOOC. Teachers stressed the need for practical support with actual examples of teaching practices that integrated AI in the classroom. They expected professional development that directly addressed how to use AI in order to facilitate professional practices, such as managing differences in levels across students and differentiating their teaching. For many teachers, the theoretical part of the pathway may have been too substantial compared to the practical, applicable part. **Professional development that incorporates moderate theoretical input and places a strong emphasis on practice would seem better suited to teachers' expectations**.

School Leader 0523 – interview excerpt: *They didn't know right away how to apply AI in the classroom. In Concretely, they didn't know the practical uses with the students.*

Teacher – answer to open question: *[What I expected from the training] were actual examples of use in class in front of students, and time to manipulate the available tools to familiarise myself with them. That's an essential step before contemplating using AI regularly with the students.*

Teacher 0612_2 – interview excerpt: *I fully appreciate the idea of 'introducing' AI and so on, but at some point, it became too dense and too much information for me. I'm a regular teacher who is concerned with what I'm going to do today in class to reduce differences in levels between students, to encourage individualized pathways in order to meet actual student needs.*



Finally, many teachers expressed their satisfaction with the learning approach. They highlighted the benefits and limitations of online resources, and they placed great value on the interactions during the face-to-face sessions. A few teachers really disliked autonomous online learning. This feedback suggests that **the use of the AI4T online learning resources should be incorporated in a professional development pathway that allows for more interactions and for continuous support.**

School leaders would also benefit from professional development on AI. Many stated that their knowledge of AI is “rather poor” and that they don’t devote much time to supporting teachers attempting to integrate AI in the classroom.

School Leader 0530 – interview excerpt: *[Interviewer: And do you think it would be relevant for school leaders to also receive training in AI?] Of course. Of course, it can be very relevant because we lack information on the subject. We can get some information from the media, but information that is specific and practical would be useful, necessary even.*

7.2 On the development of AI tools

Most teachers in the sample believed in the usefulness of AI for educational purposes. It is therefore important to **invest in technology**. Many teachers expected tools from the project – tools which they could use with their students. Overall, teachers were disappointed at not having more tools made available. Feedback from teachers pointed at the various barriers restricting access to AI tools. Many educational tools require payment. Although free access was given to mathematics teachers for the pedagogical tool Kwyk, they wished for continued access beyond the duration of the project. Generic AI tools such as ChatGPT generated other issues such as non-GDPR compliance. Teachers were therefore advised not to use this tool with their students. **To support teachers’ use of AI tools, it is important to first ensure teachers’ awareness of and access to AI tools that are both free (or paid for in the long-term) and GDPR-compliant.**

School Leader 0627 – interview excerpt: *I think there’s a bit of disappointment regarding the tools. They thought they would have access to a bank of tools, a bank of applications. Well, things that could have been more readily usable with students and I think they got a few things out of it, but I think they were expecting more than that.*

Teacher 0516_2 – interview excerpt: *As I teach maths, we are given a site that is paid for [Kwyk]. Next year, if I want to use this site, I can’t because I’d have to charge my students. So, I won’t use it.*

School Leader 0601 – interview excerpt: *The people from AI4T said that it was not usable in an educational context because it was not GDPR compliant.*

Participants also stressed that the **tools should answer specific professional needs**. These needs can vary depending on teachers’ course subject but also on students’ academic level and on the types of students. Involving teachers in the conceptual development of these tools would help address these needs more specifically.

Teacher 0516_2 – interview excerpt: *It needs to be more specific to each teacher’s work, meaning for me, as a maths and science teacher, that they need to help us more in that regard, they need to give us more tools, we know that things change very quickly [...] So if new tools became available, for example for vocational high schools, students could use AI to review homework.*

School Leader 0627 – interview excerpt: *I think that if we want the tool to be used by teachers, it has to be conceptualised by teachers. In other words, I think that if a company or a group creates a tool by relying on artificial intelligence only without consulting with teachers, then there’s little chance that the tool will be adapted to teachers’ needs and used in the classroom. There definitely needs to be teachers on the conceptual development team or as product testers because it’s quite complex.*

To identify the professional needs that AI could address, teachers answered an open question on the superpowers that they would want in order to help them do their job. Results showed that they wanted



help with marking (38.3%), **personalising teaching** (34.4%), **understanding their students and analysing their difficulties** (22.8%), and **creating lesson content and exercises** (20.6%). They were also asked at the end of the experiment whether they thought AI was useful for specific teaching practices. The categories for which most teachers thought that AI would be useful are creating course content (91.1%), marking (81.7%), monitoring students' learning and behaviour (82.8%) and analysing student errors (83.9%). **69.4% of teachers also agreed that with AI, teaching will be more personalised to students' needs.**

Teacher 0524_3 – interview excerpt: *[Marking] takes time, and it is interesting to understand student errors and to look at their levels of achievement. I think we need to continue doing this, but sometimes we might hold back on giving them tests, even formative ones, because it takes time to mark. So, I find tools like AI very interesting in our line of work, because they provide exercises, they grade them, and they give us an overview of students' levels of achievement.*

Teacher 0516_1 – interview excerpt: *Generally speaking, the ability to create a set of exercises on any given topic, that's something that will be of interest to all teachers.*

Teacher 0524_2 – interview excerpt: *If I create digital tools, digital assessment tasks or start to put content into those tools and then the artificial intelligence analyses what's going on, that's very interesting to me.*

School Leader 0627 – interview excerpt: *We know very well that there are different academic levels in any student group, and that's even truer today than it was 20 years ago. So, teachers sometimes divide students based on their very, very different levels. We could imagine having very good students working on their own to a greater extent whilst the teacher spends a bit more time with students with difficulties using tools adapted to their needs. The issue here is that we can't let students get bored. [...] I think that, in any discipline, a tool such as an AI-based app would really contribute to managing students' academic differences in class.*

Therefore, **providing teachers with AI tools that address marking, lesson planning, and that help personalization and monitoring/analysing student work would be particularly useful.**

7.3 On addressing ethical issues associated with AI

Teachers and school leaders have expressed **the need for national authorities to take the lead in ensuring that ethical considerations are taken into account when using AI tools within a school environment.** Some participants mentioned the need for national authorities to develop ethical AI tools dedicated to education. Other participants requested that AI tools be vetted by national institutions. Consistent guidelines are key to supporting the use of AI. During the experimentation year, teachers were presented with tools, such as ChatGPT, but were then forbidden to use them with students by their inspectors.

School Leader 0530 – interview excerpt: *Just think of the investment! Everything that currently exists comes from either Asia or the United States. AI-ethical tools are being developed as we speak for the general public. But it's true that we would like the Education Nationale to get involved and take responsibility for these tools.*

Teacher 0608_1 – interview excerpt: *As a teacher, I don't necessarily feel that I have the knowledge or power to say okay, I approve this. I can approve the teaching side of an AI tool, but I'm not sure I can approve anything else. In fact, I don't have any authority over a tool like this. I would need people who are competent with information technology to be able to okay that aspect.*

Teacher 0606 – interview excerpt: *We need to be presented with this tool and for it to be approved by inspectors to be sure that we stick to the rules, I think.*

Results from the school leader survey show that AI leadership is lacking at the school level. Although school leaders think that ethical issues are an important concern when bringing AI into the school, only a few have provided their staff with ethical guidelines regarding AI and data protection (34.4%). Even fewer school leaders have provided parents with ethical guidelines (9.4%). With the fast growth of AI,

participants have suggested that **school leaders must take an active role in communicating with both staff and parents on the use of AI in the school.**

School Leader 0627 – interview excerpt: *Concerning artificial intelligence, I can't see it, because it's not used that much yet. We will indeed have to consider it as it develops, when we have AI tools, we will indeed have to inform people.*

Teacher 0628 – interview excerpt: *We might need to discuss or sign, or maybe add to the internal regulations, written consent from students and parents, about the fact that we're going to use artificial intelligence in the classroom, so that its use is approved, or at least made known as a teaching resource and thus accepted by and signed by parents, families, and students.*

We observed that participants' **main concern had to do with data protection.** 62.2% of teachers think that with the development of AI in education, students' personal information will be more at risk of being leaked and used at their expense. 70.4% of students also answered that they were “definitely” or “pretty much” concerned by the potential loss of privacy due to the collection of data by AI tools. The interviewees typically mentioned data protection first and some stressed that it is an absolute requirement for the integration of AI in schools. The importance of data privacy is usually associated with the question of **transparency** on how the data being collected was used. 64.7% of teachers thought that with the integration of AI, surveillance in schools would increase, and 67.9% of teachers thought that private companies would have a greater influence on schools. Moreover, 69.9% of students were “definitely” or “pretty much” concerned by the potential use of AI for illegitimate intents.

School Leader 0627 – interview excerpt: *Teachers will leave if there's no protection of their own data and of the students' personal data, that's for sure. We see that parents are being increasingly careful about image rights, for example. So you can be sure that with artificial intelligence, they will also be very, very cautious.*

School Leader 0627 – interview excerpt: *Where is the data going? What will we do with it? Is it stored? What use does it have? There are quite a few issues here. We work with students who are, let's face it, vulnerable, and who can be easily influenced, and so if we have bad intentions, we can also damage them and that's something that catches teachers' attention and they are very careful with this. So of course, there's a degree of mistrust.*

Finally, students lack awareness regarding the debate on AI transparency, on attribution of responsibility and on discrimination resulting from the use of AI. This suggests that they could be **better informed on ethical issues surrounding AI.**

Appendices

Appendix A: Monitoring of the data cleaning process in France

	Teachers baseline	Teachers endline	School leaders	Students
Number of answers (not empty)	272	201	78	1143
Number of answers without duplicates	240	188	64	x
Number of answers having completed at least the first module of outcomes	239	185	64	1134
Number of answers having completed both questionnaires	180	180	x	x

Appendix B: Summary of the psychometric properties of the scales

Table 1: Summary of the psychometric properties of the scales for the teacher questionnaire

Name of the scale	Psychometric properties
<i>Context</i>	
Self-efficacy for integrating technology in the classroom	The scale includes 5 items. The Cronbach alpha is 0.93. The item-total correlations (Kendall's tau) are comprised between 0.76 and 0.78. There is one underlying factor that explains 72% of the variance. The factor loadings for each item are comprised between 0.84-0.86.
<i>Reactions to the professional learning pathway</i>	
Learner engagement	The scale includes 11 items. The Cronbach alpha is 0.86. The item-total correlations (Kendall's tau) are comprised between 0.41 and 0.55. There are four underlying factors. The first one explains 21% of the variance. On the first factor, the factor loadings for each item are comprised between 0.66-0.94. The second factor explains 18% of the variance. On the second factor, the factor loadings for each item are comprised between 0.69-0.79. The third factor explains 16% of the variance. On the third factor, the factor loadings for each item are comprised between 0.57-0.84. The fourth factor explains 14% of the variance. On the fourth factor, the factor loadings for each item are comprised between 0.69-0.94.
Satisfaction with the usefulness of the professional learning pathway	The scale includes 3 items. The Cronbach alpha is 0.92. The item-total correlations (Kendall's tau) are comprised between 0.82 and 0.87. There is one underlying factor that explains 79% of the variance. The factor loadings for each item are comprised between 0.85-0.94.
<i>Participants' learning</i>	
Knowledge of how AI works	The scale includes 5 items. The Cronbach alpha is 0.68. The item-total correlations (Kendall's tau) are comprised between 0.48 and 0.61. There is one underlying factor that explains 33% of the variance. The factor loadings for each item are comprised between 0.42-0.75.
Familiarity with AI technologies	The scale includes 5 items. The Cronbach alpha is 0.87. The item-total correlations (Kendall's tau) are comprised between 0.65 and 0.72. There is one underlying factor that explains 58% of the variance. The factor loadings for each item are comprised between 0.70-0.82.
Ability to identify AI tools	The scale includes 8 items. The Cronbach alpha is 0.77. The item-total correlations (Kendall's tau) are comprised between 0.31 and 0.59. There are two underlying factors. The first factor explains 31% of the variance. On the first factor, the factor loadings for each item are comprised between 0.67 and 0.89. The second factor explains 21% of the variance. On the second factor, the factor loadings for each item are comprised between 0.49 and 0.72.
<i>Perceptions of AI</i>	
Perceived ease of use of AI	The scale includes 4 items. The Cronbach alpha is 0.91. The item-total correlations (Kendall's tau) are comprised between 0.73 and 0.81. There is one underlying factor that explains 72% of the variance. The factor loadings for each item are comprised between 0.77-0.88.

Anxiety associated with use of AI and learning about AI	The scale includes 3 items. The Cronbach alpha is 0.90. The item-total correlations (Kendall's tau) are comprised between 0.74 and 0.83. There is one underlying factor that explains 69% of the variance. The factor loadings for each item are comprised between 0.73-0.91.
Enjoyment associated with use of AI and learning about AI	The scale includes 4 items. The Cronbach alpha is 0.90. The item-total correlations (Kendall's tau) are comprised between 0.79 and 0.85. There is one underlying factor. The factor loadings for each item are comprised between 0.74-0.96.
Perceived usefulness of AI for education	The scale includes 10 items. The Cronbach alpha is 0.88. The item-total correlations (Kendall's tau) are comprised between 0.86 and 0.87. There is one underlying factor that explains 45% of the variance. The factor loadings for each item are comprised between 0.57-0.73.
<i>Use of AI</i>	
Use of AI	The scale includes 4 items. The Cronbach alpha is 0.9. The item-total correlations (Kendall's tau) are comprised between 0.79 and 0.82. There is one underlying factor that explains 69% of the variance. The factor loadings for each item are comprised between 0.77-0.88.
Frequent use of AI	The scale includes 4 items. The Cronbach alpha is 0.84. The item-total correlations (Kendall's tau) are comprised between 0.69 and 0.82. There is one underlying factor that explains 58% of the variance. The factor loadings for each item are comprised between 0.75-0.83.
Ethical consciousness when using AI	The scale includes 3 items. The Cronbach alpha is 0.75. The item-total correlations (Kendall's tau) are comprised between 0.70 and 0.76. There is one underlying factor that explains 56% of the variance. The factor loadings for each item are comprised between 0.53-0.94.
Intention to use AI	The scale includes 3 items. The Cronbach alpha is 0.88. The item-total correlations (Kendall's tau) are comprised between 0.82 and 0.86. There is one underlying factor that explains 74% of the variance. The factor loadings for each item are comprised between 0.69-0.95.

Table 2: Summary of the psychometric properties of the scales for the student questionnaire

Name of the scales	Psychometric properties
Attitude towards AI in education	<p>The scale includes 8 items. The Cronbach alpha is 0.82. The item-total correlations (Kendall's tau) are comprised between 0.31 and 0.60. There are two underlying factors. The first factor explains 31% of the variance. On the first factor, the factor loadings for each item are comprised between 0.53 and 0.77.</p> <p>The second factor explains 12% of the variance. On the second factor, the factor loadings for each item are comprised between 0.53 and 0.64.</p>
Concern about ethical issues raised by AI in education	The scale includes 5 items. The Cronbach alpha is 0.82. The item-total correlations are comprised between 0.58 and 0.68. There is one underlying factor that explains 48% of the variance. The factor loadings are comprised between 0.61 and 0.75.

Appendix C: Comparisons of control variables and outcomes at the initial stage between the control group and the intervention group

Table 1: Comparisons of control variables in the intervention and control groups

Control variable	Control group	Intervention group	p-value
Sex (Percentage of men)	37%	49%	0.02**
Teaching experience (Average number of years of teaching experience)	18.94	18.26	0.45
Class size (Number of students in the class participating in the experiment)	27.38	27	0.55
Student academic difficulties (Percentage of students with academic difficulties in the class)	33.11	37.57	0.01**

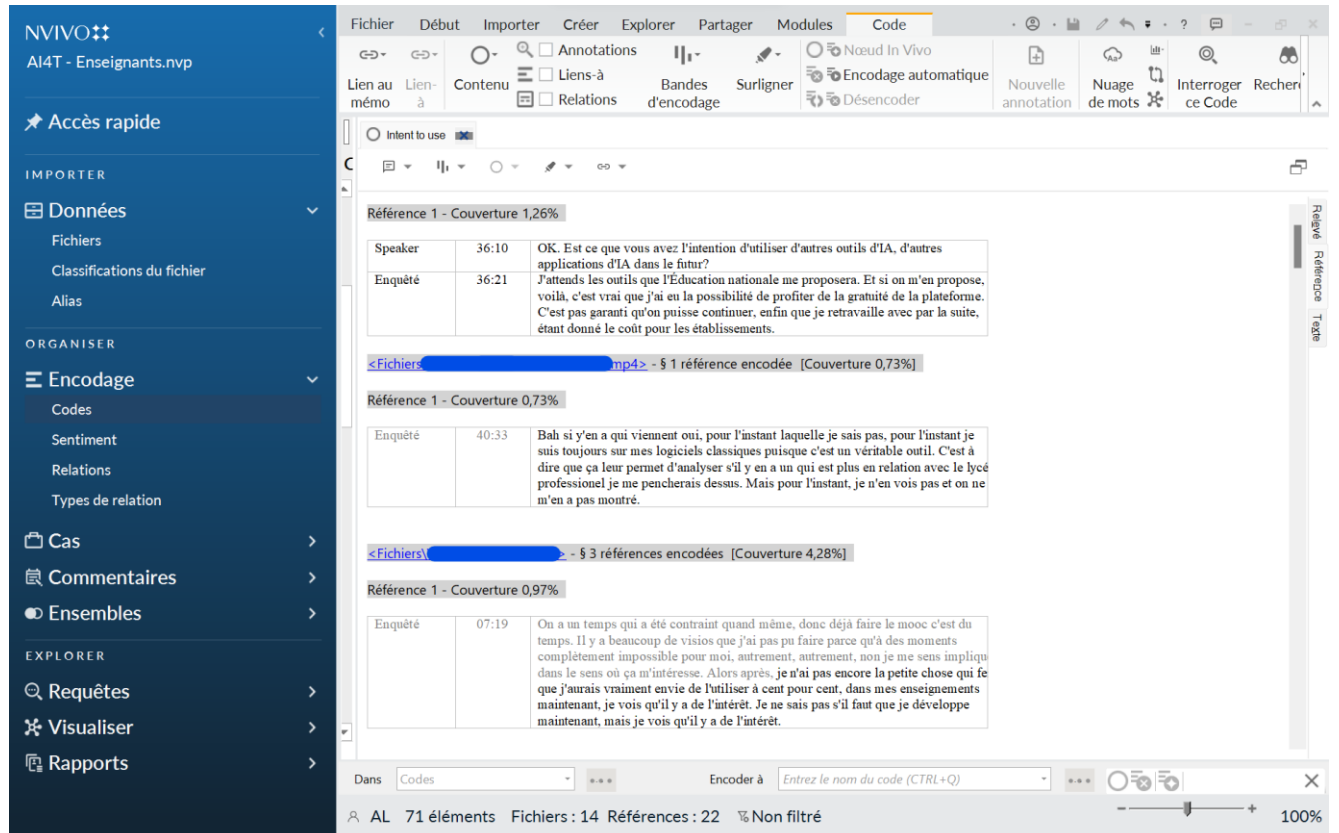
Table 2: comparisons of the means in the main outcomes at the beginning of the experiment

Outcome	Control group	Intervention group	p-value
Knowledge			
Self-assessed knowledge of AI	0.00	-0.01	0.66
Knowledge of how AI works	0.00	-0.16	0.31
Familiarity with AI technologies	0.00	-0.03	0.83
Identification of AI in tools that are mainly based on AI	0.00	-0.45	0.01***
Identification of AI in tools that are not mainly based on AI	0.00	-0.21	0.13

<i>Perceptions</i>			
Perceived ease of use	0.00	0.04	0.83
Anxiety associated with use of AI and learning about AI	0.00	0.00	0.97
Enjoyment associated with use of AI and learning about AI	0.00	-0.02	0.93
Perceived usefulness of AI for education	0.00	-0.25	0.11
<i>Use</i>			
Use of AI	0.00	-0.14	0.36
Frequent use of AI	0.00	-0.12	0.40
Ethical consciousness when using AI	0.01	0.12	0.57
Intention to use AI	0.00	-0.39	0.01***

Appendix D: Example of the codification process for qualitative data

In the extract shown below, the code intent to use was assigned to 22 chunks of text in the teachers' interviews.



The screenshot shows the NVivo software interface. The main workspace displays a list of interview transcripts with highlighted text segments and their corresponding codes. The interface includes a menu bar at the top, a left sidebar with navigation options, and a main workspace displaying interview transcripts with highlighted text segments and their corresponding codes.

Speaker	Time	Text	Code	Coverage
Speaker	36:10	OK. Est ce que vous avez l'intention d'utiliser d'autres outils d'IA, d'autres applications d'IA dans le futur?		1,26%
Enquêté	36:21	J'attends les outils que l'Éducation nationale me proposera. Et si on m'en propose, voilà, c'est vrai que j'ai eu la possibilité de profiter de la gratuité de la plateforme. C'est pas garanti qu'on puisse continuer, enfin que je retravaille avec par la suite, étant donné le coût pour les établissements.		
		<Fichiers> mp4> - § 1 référence encodée		0,73%
		Référence 1 - Couverture 0,73%		
Enquêté	40:33	Bah si y'en a qui viennent oui, pour l'instant laquelle je sais pas, pour l'instant je suis toujours sur mes logiciels classiques puisque c'est un véritable outil. C'est à dire que ça leur permet d'analyser s'il y en a un qui est plus en relation avec le lycée professionnel je me pencherais dessus. Mais pour l'instant, je n'en vois pas et on ne m'en a pas montré.		
		<Fichiers> > - § 3 références encodées		4,28%
		Référence 1 - Couverture 0,97%		
Enquêté	07:19	On a un temps qui a été contraint quand même, donc déjà faire le mooc c'est du temps. Il y a beaucoup de visios que j'ai pas pu faire parce qu'à des moments complètement impossible pour moi, autrement, autrement, non je me sens impliqué dans le sens où ça m'intéresse. Alors après, je n'ai pas encore la petite chose qui fe que j'aurais vraiment envie de l'utiliser à cent pour cent, dans mes enseignements maintenant, je vois qu'il y a de l'intérêt. Je ne sais pas s'il faut que je développe maintenant, mais je vois qu'il y a de l'intérêt.		

At the bottom of the interface, a status bar shows: Dans Codes Encoder à Entrez le nom du code (CTRL+Q) AL 71 éléments Fichiers : 14 Références : 22 % Non filtré

Appendix E: Interview excerpts in the original language with translations

TEACHERS RESULTS

Teacher 0517_2 – interview excerpt: *We've been hearing a lot about artificial intelligence lately, so it came at the right time.*

Original French: *On entend beaucoup parler d'intelligence artificielle depuis quelques temps donc ça tombait plutôt bien.*

Teacher 0523 – interview excerpt: *I was very excited to participate in this experiment since I also teach computer science, the new subject "NSI" [Numérique et sciences informatiques]. And so I was excited about the interest in artificial intelligence.*

Original French: *J'étais très emballé de participer à cette expérience puisque j'enseigne aussi dans l'informatique, la nouvelle discipline NSI. Et donc j'étais emballé par l'intérêt de l'intelligence artificielle.*

Teacher 0608_1 – interview excerpt: *It seemed interesting to me, not because I wanted to learn new things, but because I wanted to know how I could be guided, and how I could successfully find ideas for my teaching practice, and how I could use specific tools.*

Original French: *Celui-ci me semblait intéressant au départ, pas forcément pour les connaissances, mais plus pour savoir comment je pouvais être guidée, pour réussir à trouver des idées de pratiques pédagogiques pour utiliser cet outil-là.*

Teacher 0530_2 – interview excerpt: *Actually, the idea was to go and get some new information that I was far from possessing. Artificial intelligence for me wasn't really something very clear in my mind. I had some idea of what it was, but you know, I didn't really see any application in our line of work.*

Original French: *En fait, l'idée, c'était d'aller rechercher des informations que j'étais loin de détenir. L'intelligence artificielle pour moi, ce n'était pas forcément quelque chose de bien clair dans ma tête. Je voyais un peu ce que c'était, mais si vous voulez, je ne voyais pas forcément les possibilités d'exploitation dans notre métier.*

Teacher 0524_2 – interview excerpt: *The booklet, it doesn't ring a bell at all. So, well, I don't know what to say about that.*

Original French: *Le livret, ça me dit rien du tout. Donc bon, je sais pas quoi répondre là-dessus.*

Teacher 0516_1 – interview excerpt: *It doesn't ring a bell. I must not have looked into it in depth... I might have skimmed through it at some point, but right now, I don't have any recollection of it.*

Original French: *Ça ne me parle plus. J'ai pas dû le regarder en profondeur... Je l'ai peut-être parcouru à un moment donné, mais là, comme ça, je n'en ai pas gardé trace.*

Teacher 0608_1 – interview excerpt: *We were presented with projects, which were at an embryonic stage and which were not really in place yet and that we couldn't use. [...] But we also saw things that we hadn't seen before, such as tools, etc. But this came a little late in the year. What I would have found more interesting is to have tools right away: "go test this and see what happens". In the end, I found myself using things I was already using.*

Original French: *Il nous a même été présenté des projets, des embryons de projets, mais qui n'étaient pas encore réellement actifs et qu'on ne pouvait pas utiliser. [...] Mais on a aussi vu des choses que l'on n'avait pas vues, notamment les outils, etc. Mais c'est arrivé un petit peu tard en fait dans l'année.*



Ce que j'aurais trouvé plus intéressant, c'est d'avoir tout de suite des outils : 'aller tester ça et puis voyez un peu ce que ça donne'. Finalement, je me suis retrouvé à utiliser des choses que j'utilisais déjà.

Teacher 0523 – interview excerpt: So, to set the scene, the first webinar, it was in December, and that's when we were introduced to the Kwyk platform and Vocacoach for colleagues teaching English. But then, I started using this platform at the beginning of January, but we had no guidelines. It was more like, figure it out on your own.

Original French: *Donc, pour situer le premier webinaire, vous êtes en décembre et c'est là qu'on nous a présenté la plateforme Kwyk et puis Vocacoach pour les collègues d'anglais. Mais du coup, moi, j'ai commencé à utiliser cette plateforme début janvier, mais on n'avait pas de directives. En fait, c'était un peu débrouillez-vous.*

Teacher 0524_3 – interview excerpt: *In terms of tools to share with students and to use every day, or at least tools authorised by the Education Nationale... We talked about ChatGTP, things like that, but it's a bit delicate to use. We haven't really discovered a tool that we can use well, and that is been authorised by everyone yet, I believe.*

Original French: *Mais du coup en termes d'outils à redonner aux élèves et pour s'en servir tous les jours, ou en tout cas d'outils autorisés par l'Education Nationale... On a parlé de ChatGTP, de choses comme ça, mais c'est un peu délicat de l'utiliser. On n'a pas vraiment découvert un outil qu'on peut bien utiliser, autorisé par tout le monde encore je crois.*

Teacher 0612_2 – interview excerpt: *I fully understand the concept of 'introducing' AI and so on, but at some point, it became too dense and too much information for me. I'm a regular teacher who is concerned with what I'm going to do today in class to reduce differences in levels between students, to encourage self-directed learning in order to meet actual student needs.*

Original French: *Je comprends tout à fait l'aspect 'initier' un petit peu sur ce qu'est l'IA et ainsi de suite, mais à un moment donné, ça devenait trop dense et trop d'informations pour la cible que je représente, à savoir l'enseignant qui lui, a la préoccupation de qu'est-ce que je peux mettre en place aujourd'hui au sein de ma classe afin de réduire l'hétérogénéité que je constate, afin de favoriser des parcours individualisés afin de répondre à des demandes concrètes.*

Teacher 0516_3 – interview excerpt: *I am rather in favor of the blended-learning. [...] I mean, face-to-face has its advantages, but also its disadvantages. And the MOOC allowed me to do things during off-peak time, in my personal time, whenever I wanted, I can take a break, etc. Yes, blended-learning is by far the best thing, that's for sure.*

Original French: *Je suis plutôt pour l'hybride. [...] Je veux dire, le présentiel, il a des avantages, mais il a des inconvénients. Et le MOOC m'a permis de le faire à des moments complètement creux, personnels, quand je veux, je m'arrête un moment, etc. Oui, l'hybride c'est de loin la meilleure chose. Moi je suis convaincu.*

Teacher 0612_1 – interview excerpt: *The face-to-face session was also nice because it allowed us to meet with colleagues and have a little chat.*

Original French: *Après le présentiel était chouette aussi parce qu'il nous a permis de rencontrer des collègues et de discuter un petit peu.*

Teacher 0628 – interview excerpt: *So I have a very clear preference for the face-to-face session, it's really what was the most valuable, the most interesting, the most motivating aspect for me. [...] Then, even in the face-to-face session, we didn't do any activities that I could use in the classroom, in my opinion.*



Original French: *Alors avec une très nette préférence pour le présentiel, c'est vraiment ce qui était le plus enrichissant, le plus intéressant, le plus motivant. [...] Après, même dans le présentiel, on n'a pas fait d'activités qui étaient pour moi adaptables en classe.*

Teacher 0516_2 – interview excerpt: *I found the MOOC interesting [...]. I found it quite fun [...] it was enjoyable and well done.*

Original French: *Le MOOC, je l'ai trouvé intéressant [...]. Je trouvais ça assez ludique [...] c'était plaisant et bien fait.*

Teacher 0516_1 – interview excerpt: *When you train on the online platform, you can do it at your own pace, and look at things several times.*

Original French: *Quand on suit sur la plateforme en ligne, on a la possibilité de le faire à son rythme, de regarder les choses plusieurs fois.*

Teacher 0530_2 – interview excerpt: *Doing a course on a computer... sometimes I struggle. When it's too long, I switch off. And it's also true that in this MOOC, there was a lot of information to take in. So I took it in, but at some points, it was overload.*

Original French: *Suivre un cours devant un ordinateur, quelques fois j'ai un peu de mal. Quand c'est trop long, je décroche. Et c'est vrai aussi que dans ce MOOC, il y avait énormément d'informations à prendre. Donc j'en ai pris, mais à un moment donné, je pense qu'il y a une certaine forme de saturation.*

Teacher 0623 – interview excerpt: *I read it thoroughly [...]. But there were parts that were marked as 'in progress' where sometimes it suggested that there were worksheets for students. I couldn't access those parts because either they wouldn't load, or they were being finalised, or something like that.*

Original French: *Par contre, lui, je l'ai lu en long et en large [...]. Mais il y avait des parties qui étaient marquées en développement où des fois ça laisse entendre qu'il y avait comme des fiches de travail à destination des élèves. Je n'ai pas pu avoir accès à ça parce que soit ce n'était pas ouvert, ou soit c'est en cours de finalisation ou quelque chose comme ça.*

Teacher 0517_2 – interview excerpt: *I found the second webinar a bit disappointing actually, because I felt it was just repeating what was in the MOOC.*

Original French: *J'ai trouvé un peu dommage le deuxième webinaire, en fait, parce que je trouvais que c'était une redite du MOOC.*

Teacher 0522 – interview excerpt: *The webinars were led by people who were AI theoreticians rather than hands-on practitioners having to face students, and who could have given us feedback on how they use AI with students.*

Original French: *Les webinaires étaient vraiment animés par des gens qui étaient finalement plus des théoriciens de l'intelligence artificielle plutôt que des praticiens de terrain avec des élèves face à eux et qui auraient pu nous faire un retour sur comment ils s'en servent devant les élèves.*

Teacher 0612_1 – interview excerpt: *It was a bit difficult for us, it was often at the end of the school day. First of all, you had to be able to be there. I live far from the school so I have a bit of a journey, it wasn't easy.*

Original French: *C'était un peu difficile pour nous, c'était souvent en fin de journée. Déjà, il fallait pouvoir être là. Moi, je suis un établissement où, quand même je suis assez loin donc j'ai un peu de trajet, c'était un peu compliqué.*

Teacher 0516_1 – interview excerpt: *Having webinars on these topics afterwards allowed us to get some extra information and to ask questions that we had previously made a note of.*



Original French: *Le fait d'avoir des webinaires sur ces sujets-là par la suite, ça nous permet d'avoir des informations supplémentaires et de poser des questions qu'on avait pu noter entre guillemets auparavant.*

Teacher 0530_2 – interview excerpt: Actually, I find it rather positive that this has led me to question myself more than at the beginning. If I question myself, it means that there were elements that have enriched my knowledge.

Original French: *En fait, je trouve même que c'est plutôt positif que ça me questionne plus que au départ. Si ça me questionne, ça veut dire qu'il y a eu des éléments qui sont venus alimenter ma connaissance.*

Teacher 0517_2 – interview excerpt: I learnt a bit about how it was built, data stuff... Now, I must admit that there are things that are still too complex. Neural networks... among other things... I don't have my notes with me, I didn't memorise everything, but there are concepts that are a bit more complex to understand. Now, do we really need to understand them... Well, it's part of the tool. Overall, I understood how it works, but not necessarily in much detail.

Original French: *J'ai appris un peu comment c'était bâti, les histoires de données. Après, je vous avouerais qu'il y a des choses qui sont compliquées quand même. Tout ce qui est réseau de neurones... entre autres... je n'ai pas mes notes avec moi, je n'ai pas tout retenu, mais il y a des concepts qui sont un peu plus compliqués à comprendre. Après est ce qu'on a vraiment besoin de les comprendre... Bon, ça fait partie de l'outil, j'ai compris globalement le fonctionnement, pas forcément dans le détail.*

Teacher 0608_1 – interview excerpt: When there were questions like, 'are you sure this contains AI or not?', there were times when I wasn't really sure and that allowed me to become more confident and be able to talk about it, especially during the SNT [Numérique et sciences informatiques] class with my students.

Original French: *Quand il y avait des questions, 'est ce que vous êtes sûr que ça contient de l'IA ou pas?', il y a des moments où je n'étais pas vraiment sûr et ça, ça m'a permis d'avoir plus de confiance et de pouvoir en parler, notamment au cours de SNT à mes élèves.*

Teacher 0530_1 – interview excerpt: Now, we still struggle, even me, I confuse AI with digital tools. The differences aren't always clear.

Original French: *Après on a du mal encore, même moi, à confondre IA et puis outils numériques. La frontière est un peu floue.*

Teacher 0530_1 – interview excerpt: No, not enough in my opinion. It seemed to me that instructors' perspective was more about how useful it'd be with our students. This rather left aside the ethical questions that could arise.

Original French: *Non, pas suffisamment à mon sens. Il m'a semblé que le point de vue des formateurs était plutôt le côté utilité avec nos élèves. Ça prenait largement le pas sur les questions éthiques que ça pouvait poser.*

Teacher 0612_1 – interview excerpt: It was mentioned. That's how I learnt that Duolingo has some shortcomings. Indeed, it is a private tool and there is no formal agreement to date regulating its use with the Education Nationale. [...] It also helped a little in raising awareness concerning the different applications that we think are rather nice but in the end, they capture a lot of things related to our daily lives. It has also caused me to think before using certain applications and downloading them.

Original French: *Ça a été évoqué. C'est comme ça que j'ai appris que Duolingo avait ses limites. En fait, c'était privé et il n'y avait pas forcément encore les accords avec l'éducation nationale. [...] Ça a permis aussi d'alerter un petit peu sur toutes les ramifications qu'on pouvait avoir entre les différentes applications que l'on pense toutes sympa et puis en fin de compte, elles captent beaucoup de choses*



liées à notre quotidien. Ça a permis aussi de réfléchir un petit peu avant d'utiliser certaines applications et de les télécharger.

Teacher 0623 – interview excerpt: *I went to look at other platforms... I think it's called Twee. It's a platform for teachers. It's the same, you enter your theme, students' level, and then it gives you lots of exercises. It's mind-blowing because I see real interest in it. [...] What I also wish for, and haven't exploited yet, is trying to create personalised pathways through artificial intelligence. I'm not there yet. That's what I would like to do. [...] I think that's where artificial intelligence could really help me manage differences in levels between students.*

Original French: *Je suis allé voir dans d'autres plateformes... Je crois que ça s'appelle Twee. C'est une plateforme pour les enseignants. C'est pareil, vous rentrez votre thème, le niveau et puis alors il vous décline plein d'exercices. Ça tourne la tête parce que moi j'y vois un vrai intérêt. [...] Ce que je regrette, ce que j'ai pas encore exploité, c'est d'essayer de faire des parcours individualisés via l'intelligence artificielle. Ça, je n'en suis pas encore là. C'est ce que j'aimerais faire. [...] Je pense que là, l'intelligence artificielle pourrait me donner des clés pour gérer cette hétérogénéité-là.*

Teacher 0608_2 – interview excerpt: *Clearly, yes, there is a time-saving benefit, meaning that before, it took me half an hour to make a spreadsheet to collect data from a table on ranking the ten countries relative to their GDP with different types of information, and when I ask ChatGPT, it does it in thirty seconds.*

Original French: *Clairement, oui, il y a un gain en temps de travail, c'est à dire qu' avant je mettais une demi-heure à faire un tableur pour récupérer les données d'un tableau sur classer les dix pays par leur PIB avec les différentes informations, c'est sûr quand je demande à ChatGPT, il le fait en trente secondes.*

Teacher 0524_2 – interview excerpt: *There was a time when I received emails providing an overall analysis of students' work and I thought that was great. In fact, I got reports showing which student had made the most progress, the most deserving student... I used it once with the students, I showed them the results. It's quite funny because students recognised themselves and it's something that is quantified, it's objective. This is not a subjective interpretation. That's the advantage of artificial intelligence. As human beings, we're not always objective in our analyses.*

Original French: *Y a un moment, j'ai reçu des emails en faisant des bilans et je me suis dis ça, c'est génial. En fait, j'avais des bilans disant l'élève qui a le plus progressé, l'élève le plus méritant... Je l'ai utilisé une fois avec les élèves, je leur ai montré le résultat que ça donnait. C'est assez marrant parce que les élèves se reconnaissent et c'est un truc qui est chiffré, c'est objectif. On n'est pas dans le subjectif. C'est ça l'avantage de l'intelligence artificielle. C'est que moi, en tant qu'humain, quand j'analyse, on n'est pas non plus forcément dans l'objectif.*

Teacher 0516_3 – interview excerpt: *I'm thinking of marking maths papers, because that's one of the things that wears me out in my job and which I find takes us away from the number one goal, which is to help someone. When we spend hours marking papers, we are not helping our students. We are doing a task that is required of course, but which could very well be handled by AI on a massive scale. And what's more, AI would do it ten times better than us.*

Original French: *Je pense à la correction en maths, parce que oui, ça fait partie des trucs qui me soule dans mon métier et qui je trouve, nous éloigne de l'objectif numéro un, c'est à dire aider quelqu'un. Quand on corrige des copies pendant des heures, on n'est pas en train d'aider nos élèves. On est en train de faire une tâche qui est nécessaire bien sûr, mais qui pourrait très bien être prise en charge par des IA de manière massive. Et en plus ça le ferait dix fois mieux que nous.*

Teacher 0516_3 – interview excerpt: *The fact that the training gave me insights allowed me to read through what was being said, and especially to see ChatGPT for myself, and to see that it is not really a source of danger.*

Original French: *Le fait que la formation m'a donné des billes, m'a permis de lire au travers de ce qui se disait, et surtout de voir moi-même ChatGPT, de voir moi même que ce n'est pas forcément un danger.*

Teacher 0523 – interview excerpt: *There is a crucial problem, which is personal data, so obviously this is an ethical issue. With Kwyk, we had to provide students' names and personal details to register them. So, this is a main problem.*

Original French: *Voilà, on en revient à un problème crucial, c'est les données personnelles, donc un problème d'éthique forcément. D'ailleurs Kwyk, on a dû donner les noms d'élèves et tout pour les inscrire. Voilà donc, il y a ce problème qui est un des principaux.*

Teacher 0612_1 – interview excerpt: *But in fact, what was also very nice is that they showed us everything related to ChatGPT via Discord – an application for creating drawings. And it was indeed impressive. I would certainly have used it otherwise, but not as fast as I did.*

Original French: *Mais en fait, ce qui était aussi très chouette, c'est qu'on nous a montré tout ce qui était lié à ChatGPT via Discord, l'application pour pouvoir créer du dessin. Effectivement, là c'était bluffant. Je l'aurais très certainement utilisé, mais pas dans le contexte aussi rapide.*

Teacher 0516_1 – interview excerpt: *[Kwyk] had real added value. Again, it's always the same, for students who want to keep up. So we're talking about students whose marks are between 8 and 10, who are not very comfortable with mathematics, but who want to hang in there, and progress, and who know that it's important and that they are working for themselves and for their future. It isn't many students, but for these students, some said, it amounted to an extra two to three hours of maths per week as they did the exercises over and over.*

Original French: *[Kwyk] a eu une réelle plus-value. Alors, c'est toujours pareil, pour les élèves qui souhaitent s'accrocher. Donc on va dire qu'on est sur les élèves qui sont entre 8 et 10, qui sont pas forcément très à l'aise en mathématiques, mais qui ont envie de pas décrocher, de s'accrocher, de progresser, qui savent que c'est important et qu'ils travaillent pour eux et pour leur avenir. Ça ne fait pas beaucoup d'élèves sur nos classes, mais pour ces élèves là ça a vraiment été l'équivalent, certains ont dit, l'équivalent de pouvoir faire deux ou trois heures de soutien de maths dans la semaine parce qu'ils refaisaient, refaisaient, refaisaient.*

Teacher 0530_2 – interview excerpt: *Yes, I think having access to the Kwyk platform, which helps generate exercises at all high school levels, and to create homework with very interesting learning options, especially the ability to program the number of attempts for completing homework tasks, which in turn allows for some customisation. You can give one or two extra attempts to students who struggle. So I worked a lot on this platform with my students and it was a very positive experience.*

Original French: *Oui, je pense d'avoir accès à la plateforme Kwyk, qui est une plateforme permettant de faire de l'entraînement à des exercices de la sixième jusqu'à la terminale, de créer des devoirs maison avec des options très intéressante en termes pédagogiques, notamment le fait de programmer le nombre de tentatives pour faire le devoir, ce qui permet de personnaliser un peu les choses. On peut penser qu'on peut donner une ou deux tentatives de plus à des élèves en difficulté. Donc j'ai beaucoup travaillé sur cette plateforme avec mes élèves et ça a été une très bonne expérience.*

Teacher 0516_2 – interview excerpt: *As I teach maths, we were given a site that you [normally have to pay for] [Kwyk]. Next year, it's quite simple, I can't use this website because I'd have to charge my students. So I'm not going to use it and I'm going to try to find other platforms. The second thing is that they are not adapted to vocational high schools. I will be looking for exercises that correspond to the*

early middle school curriculum, from sixième [6th grade] to cinquième [7th grade]. I don't really have here exercises that I could give them. So I'm going to use it for small calculations, for introductory notions, but not for a chapter or as other high schools or middle schools might do. It's not a good tool for us.

Original French: *Comme je suis en maths, on nous donne un site qui est payant [Kwyk]. Que l'année prochaine, si j'utilise ce site, c'est facile, je ne peux pas l'utiliser, sinon je dois faire payer mes élèves. Donc je ne vais pas l'utiliser et je vais essayer de trouver d'autres modèles. Mais le deuxième truc, c'est qu'ils ne sont pas adaptés au lycée professionnel. Je vais aller chercher des exercices qui sont liés au collège, la sixième à la cinquième. J'ai pas vraiment les exercices qui pourraient être liés à ce que je pourrais donner. Donc je vais l'utiliser pour faire du petit calcul, une entrée en matière, mais pas pour faire un chapitre ou comme pourraient faire les autres lycées ou les autres collèges. C'est pas un bon outil pour nous.*

Teacher 0612_2 – interview excerpt: *And recently, just at the end of the year, I had a first-year student who told me she was experiencing difficulties. One day, while talking, I told her to try [Duolingo], I heard about it during the training, to see if it could help her. And later, she was proud to tell me 'You know, I've reached 100 consecutive days'. That's great but I didn't know what to do with that... Because I was waiting to be given a tool to test out, as had been mentioned in the training description... it's true that I didn't share it with all my students. And I wasn't able to see what was happening for the two or three students I had suggested it to. Because I thought I was more in the experimentation phase trying out and testing this tool.*

Original French: *Et dernièrement, juste à la fin de l'année, là j'ai eu une élève de première qui m'a dit qu'elle était en grande difficulté. Un jour, en discutant, je lui dis essaye [Duolingo], on m'en a parlé dans une formation, essaye pour voir si ça peut t'aider. Et tout fièrement, elle m'a dit 'Vous savez, j'en suis rendue à 100 jours d'affilés'. Voilà mais comme c'était quelque chose qui n'était pas... Parce que c'est vrai que j'étais dans l'attente qu'on me donne un outil à tester tel que ça avait été évoqué dans le descriptif de la formation... c'est vrai que je n'ai pas non plus répandu à tous mes élèves. Et je n'étais pas dans une observation de ce qui se passait pour les deux ou trois élèves à qui je l'avais suggéré. Parce que je pensais être plutôt dans la phase expérimentation avec un outil qui aurait été donné, qu'il fallait tester auprès de tout le monde.*

Teacher 0623 – interview excerpt: *[I tested Vocacoach with] one class, but it wasn't really successful because I had to create individual accounts for the students and they were only allowed to go there once. After that, access was blocked. [...] Anyway, I tested it.*

Original French: *[J'ai testé Vocacoach avec] une classe, mais ça n'a pas été vraiment couronné de succès parce que j'ai dû créer des comptes individuels pour les élèves et ils n'ont eu droit d'y aller qu'une seule fois. Après, ça a bloqué l'accès. [...] En tout cas, j'ai testé.*

Teacher 0517_1 – interview excerpt: *For me, it's a lot of preparation work. So I can't tell you today that I'm going to use such and such tool until I've integrated it into a teaching methodology that isn't shaky because using AI just for the sake of using AI is no good.*

Original French: *Pour moi, c'est un gros travail de préparation. Donc je peux pas vous dire maintenant aujourd'hui que je vais utiliser tel outil tant que je ne l'ai pas intégré dans une logique d'enseignement qui ne soit pas bancal parce que si c'est pour mettre de l'IA, pour mettre de l'IA, ça sert à rien.*

Teacher 0516_1 – interview excerpt: *I'm waiting to see the tools that the Education Nationale will make available to me. It's true that I've had the opportunity to use the free platform... But there's no guarantee that we can continue using it, and that I will keep working with it in the future, given the costs for the school.*



Original French: *J'attends les outils que l'Éducation nationale me proposera. C'est vrai que j'ai eu la possibilité de profiter de la gratuité de la plateforme... C'est pas garanti qu'on puisse continuer, que je retravaille avec par la suite, étant donné le coût pour les établissements.*

Teacher 0614_2 – interview excerpt: *And in that case, it's true that given the possibility, given that our administrator agrees to the new textbooks and possibly to a software like Kwyk, I think this is something I would really enjoy using. But we were told we don't have the budget for it. So, unfortunately, we're not feeling very confident.*

Original French: *Et dans ce cas-là, c'est vrai que si on a la possibilité, si notre gestionnaire veut bien qu'on ait des nouveaux manuels et éventuellement des logiciels comme Kwyk, je pense que c'est quelque chose que j'utiliserai avec plaisir. Mais on nous a dit qu'il n'y avait pas de sous. On n'est pas très confiant pour ça. Malheureusement.*

Teacher 0516_2 – interview excerpt: *Well, if there are some [tools] coming, that'd be great. For now, I'm not sure which ones would be best, for now I'm still using the usual software since it's an actual tool. If there's one that is better suited to vocational high school teaching, I'll look into it. But for now, I am not seeing any and no one has shown me any.*

Original French: *Bah si y'en a qui viennent oui. Pour l'instant, lesquels, je sais pas, pour l'instant je suis toujours sur mes logiciels classiques puisque c'est un véritable outil. S'il y en a un qui est plus en relation avec le lycée professionnel, je me pencherai dessus. Mais pour l'instant, je n'en vois pas et on ne m'en a pas montré.*

Teacher 0608_1 – interview excerpt: *If ChatGPT no longer requires a phone number, I can see myself testing it out. I need to see its limitations with younger students, who're under 18. But so long as the terms of use remain as they are, we can't use this tool.*

Original French: *Si chat gpt n'exige plus un numéro de téléphone, je me verrais bien le tester. En tout cas pour en voir les limites avec des élèves plus jeunes, avec des mineurs. Mais tant que les conditions d'utilisation sont les mêmes, c'est pas possible.*

SCHOOL LEADERS RESULTS

School Leader 0627 – interview excerpt: *The computer needs charging. The problem is, when you have 35 students, and half of them arrive with a computer with a dead battery, what do you do? It seems silly, but it's not at the scale of a school with close to 2000 students.*

Original French: *L'ordinateur, il faut qu'il soit chargé. Le problème quand on a 35 élèves, si on a la moitié qui arrive avec un ordinateur batterie déchargée, comment on fait ? Ça paraît idiot, mais ça ne l'est pas à l'échelle d'un établissement de presque 2000 élèves.*

School Leader 0627 – interview excerpt: *I was immediately interested. I thought, hey, there might be something to explore, tools to bring into our practice, good ideas that can be deployed in schools for students. So, I wanted us to apply, and I started to talk to some teachers, and immediately I got a positive response. Let me tell you, the four volunteers we have were amongst the first five or six that I contacted. [...] I found out we were selected in April. Between November and April, we received zero information. Nothing came through. I just had my teachers telling me, well, we had a training session for one day. [...] There should have been an email telling us, listen, you are in the participant sample, you will get this type of information, you will receive this type of training, etc. Had this been the case, I admit, I would have followed the process a bit more closely, I would probably have pushed the teachers a bit more.*

Original French: *Moi, ça m'a tout de suite intéressé. Je me suis dit, tiens, il y a peut-être quelque chose à creuser, des outils à récupérer, des bonnes idées qui peuvent être déployées dans les établissements pour les élèves. Et donc moi, j'ai souhaité qu'on se porte candidat et j'ai commencé à aller voir quelques enseignants et j'ai tout de suite eu des réponses. Voilà, je vais vous dire que les quatre réponses, ce doit être dans les cinq six premiers que j'ai contactés. [...] J'ai compris qu'on était retenu au mois d'avril. Oui, entre novembre et avril, on a eu zéro info. Y a rien qui est arrivé. J'ai juste mes enseignants qui m'ont dit bah, on a été en formation une journée. [...] Il aurait fallu un mail nous disant oui écoutez, vous êtes dans le panel, vous allez avoir telle info, vous avez telle formation, etc. Et là, je vous avoue, j'aurais suivi un peu plus près, j'aurais probablement lancé un peu plus les enseignants.*

School Leader 0601 – interview excerpt: *The only satisfactory experience in this regard was that of the maths teacher. So it affected one teacher. So, there was no catalyst or momentum effect that was set in motion.*

Original French: *La seule expérience satisfaisante à cet égard a été celle du prof de math. Donc ça a touché un prof. Donc on n'a pas un effet de catalyseur ou d'entraînement qui s'est mis en place.*

School Leader 0530 – interview excerpt: *I would like, for next year, if this project were to continue, to include a lot more staff.*

Original French: *J'aimerais l'an prochain, si ce type de projet est reconduit, j'aimerais pouvoir le généraliser à plus de personnel.*

School Leader 0530 – interview excerpt: *I didn't have to provide anything, and/or set up any special arrangements for them to undertake this training. Everything went smoothly. In fact, they gave us some very positive feedback – they found that participating in this project was not a source of disruption or pressure, and it gave a degree of freedom to the teachers who were involved. So there were no particular issues on that level.*

Original French: *Je n'ai pas eu à m'investir et/ou à mettre en place des choses dérogatoires pour qu'ils puissent suivre cette formation. Tout s'est bien passé correctement. Justement, ça a été un retour très positif qu'ils nous ont fait. C'est-à-dire qu'ils ont trouvé que cette participation à ce projet n'était pas n'était pas, comment dirais-je, ni intrusive, ni ne mettait la pression sur les personnels, laissait une certaine liberté aux enseignants qui étaient engagés. Donc il n'y a pas eu de souci particulier à ce niveau-là.*



School Leader 0601 – interview excerpt: *I use it a lot, quite often, quite frequently, to help me when I write documents. So, it ranges from making a presentation, to producing a summary, to helping me draft an email on a given topic, or a speech, or an internship agreement, or a partnership agreement or association statutes. So yeah, it's a really practical tool for that, because, well, we don't need to reinvent lukewarm water.*

Original French: *Je l'utilise beaucoup, beaucoup, assez souvent, assez fréquemment sur des aides à la rédaction de documents. Alors ça va de présenter un sujet, enfin, avoir une présentation synthétique sur un sujet, à m'aider à rédiger un mail sur tel ou tel sujet, ou un discours, ou une convention de stage, ou une convention de partenariat ou des statuts d'association. Donc voilà, c'est vraiment pratique pour ça, parce que voilà, on n'a pas besoin de réinventer l'eau tiède.*

School Leader 0525 – interview excerpt: *The first part of the question about whether I want them to use it, personally, I don't have an opinion on that. Same as with digital technology, it's up to each teacher to decide... if I do a digital session, is it... what I question is what the educational effectiveness of AI is. And that's for each teacher to assess with the academic inspector.*

Original French: *La première partie de la question, est-ce que je veux qu'ils l'utilisent, je dirais, personnellement, j'ai pas d'idée là-dessus. C'est à chaque enseignant, c'est pareil pour le numérique, de savoir, si je fais une séance numérique, est ce que... ce que j'interroge, c'est quelle est l'efficacité pédagogique. Et donc ça c'est à l'enseignant de l'évaluer avec son inspecteur pédagogique.*

School Leader 0530 – interview excerpt: *Yes, of course, I tell them to use it when I talk about it. First, we have to because students can also use it, so we need to know what it's about. So, they will be encouraged to use it, of course. In any case, it's a part of our society now.*

Original French: *Oui, bien sûr, je leur dis d'utiliser, moi, quand j'en parle. D'abord, il faut l'utiliser parce que les élèves peuvent l'utiliser aussi à leur niveau, donc il faut savoir ce qu'il y a derrière. Donc ils seront incités à l'utiliser, bien sûr. En tout cas, ça fait partie du paysage maintenant.*

School Leader 0627 – interview excerpt: *[Interviewer: Is AI already a subject of reflection in your institution?] Not at all. Not at all, in fact. I think there aren't many people who fully understand it, even though we hear more and more about ChatGTP, and it's the one that is the most mentioned by teachers. Even though it might not have a good reputation, it's out there and it gets around. Besides these four teachers who are committed to some extent to integrating AI, and besides what we hear in the media or what we might read in some online discussions, I think there aren't many people who are very committed to AI. It's still a bit like science fiction.*

Original French: *[Interviewer : Est ce que l'IA fait déjà l'objet d'une réflexion dans votre établissement?] Pas du tout. Pas du tout en fait. Je pense qu'il y a pas grand monde qui maîtrise, même si là on entend de plus en plus parler de ChatGTP, et c'est celui qui circule le plus en salle des professeurs. Même s'il a pas forcément bonne presse. Il circule avec plutôt un aspect négatif des choses. Mais sinon, à part ces quatre enseignants-là qui sont modestement investis dans cet aspect-là des choses, les autres, non à part ce qu'on entend dans les médias ou ce qu'on pourrait entendre dans certains échanges sur Internet, je pense qu'il y a pas grand monde qui est très investi dans ce domaine. Ça reste encore un petit peu de la science-fiction.*

School Leader 0525 – interview excerpt: *We try to direct students and teachers towards tools that are GDPR compliant. Our digital and educational adviser sends out information to the school on a regular basis.*

Original French: *On essaie d'orienter les élèves et les professeurs vers l'utilisation d'outils qui sont compatibles au RGPD. Le référent aux usages numériques et pédagogiques envoie régulièrement des informations.*

TAKEAWAYS FROM TEACHERS AND SCHOOL LEADERS

Teacher 0516_3 – interview excerpt: *I think there are quite a few teachers who, because of ChatGTP, are starting to get scared or want to be trained because they feel it's becoming urgent. The need for training has become pressing.*

Original French: *Je pense qu'il y a quand même pas mal de profs qui, à cause de ChatGTP, commencent à avoir peur ou envie de se former eux-mêmes parce qu'ils sentent que ça devient urgent. Il y a une augmentation de la vitesse du besoin.*

Teacher 0530_2 – interview excerpt: *Earlier, you talked about the potential dangers of AI. That's something I think is important to point out to students. But to talk about AI, you need to really understand the subject, and when I talk about a topic, I like to know it inside out and I'm not there with AI. It's not even that I'm not there, it's that I don't know what I'm talking about and I can't imagine bringing this up with students if I don't.*

Original French: *Tout à l'heure, vous avez parlé éventuellement des éventuels dangers de l'IA. Alors ça, c'est quelque chose que je pense qu'il est important de signaler aux élèves. Mais pour en parler, il faut bien maîtriser le sujet et en général, quand je parle d'un sujet, j'aime bien le maîtriser et là je suis un peu dans le doute. C'est même pas je suis dans le doute, c'est que je maîtrise pas encore et je ne me vois pas en parler, si je maîtrise pas.*

School Leader 0523 – interview excerpt: *They didn't know right away how to apply AI in the classroom. In Concretely, they didn't know the practical uses with the students.*

Original French: *Ils n'ont pas su tout de suite comment pouvoir appliquer en classe. Concrètement, ils ont pas su les usages pratiques à faire avec les élèves.*

Teacher – answer to open question: *[What I expected from the training] were actual examples of use in class in front of students, and time to manipulate the available tools to familiarise myself with them. That's an essential step before contemplating using AI regularly with the students.*

Original French: *[J'attendais de la formation] des exemples d'utilisation concrète en classe devant élèves, et du temps de manipulation des outils disponibles pour me familiariser, étape indispensable avant d'envisager une pratique régulière devant et avec mes élèves.*

Teacher 0612_2 – interview excerpt: *I fully appreciate the idea of 'introducing' AI and so on, but at some point, it became too dense and too much information for me. I'm a regular teacher who is concerned with what I'm going to do today in class to reduce differences in levels between students, to encourage individualized pathways in order to meet actual student needs.*

Original French: *Je comprends tout à fait l'aspect 'initier' un petit peu sur ce qu'est l'IA et ainsi de suite, mais à un moment donné, ça devenait trop dense et trop d'informations pour la cible que je représente, à savoir l'enseignant qui lui, a la préoccupation de qu'est-ce que je peux mettre en place aujourd'hui au sein de ma classe afin de réduire l'hétérogénéité que je constate, afin de favoriser des parcours individualisés afin de répondre à des demandes concrètes.*

School Leader 0530 – interview excerpt: *[Interviewer: And do you think it would be relevant for school leaders to also receive training in AI?] Of course. Of course, it can be very relevant because we lack information on the subject. We can get some information from the media, but information that is specific and practical would be useful, necessary even.*

Original French: *[Interviewer: Et vous pensez que ça pourrait être pertinent que les chefs d'établissement aussi reçoivent une formation à l'IA ?] Bien sûr. Bien sûr, ça peut être très pertinent parce qu'on manque d'information sur ce sujet. On peut éventuellement avoir des informations dans la presse, mais une information précise, concrète, ça paraît utile, voire nécessaire.*



School Leader 0627 – interview excerpt: *I think there's a bit of disappointment regarding the tools. They thought they would have access to a bank of tools, a bank of applications. Well, things that could have been more readily usable with students and I think they got a few things out of it, but I think they were expecting more than that.*

Original French: *Je crois qu'il y a une petite déception par rapport aux outils. Ils pensaient avoir accès à une banque d'outils, une banque d'applications. Bon, voilà des choses qui étaient peut-être un peu plus exploitables directement avec les élèves et je pense qu'ils ont grappillé quelques éléments, mais je pense qu'ils s'attendaient à plus que ça.*

Teacher 0516_2 – interview excerpt: *As I teach maths, we are given a site that is paid for [Kwyk]. Next year, if I want to use this site, I can't because I'd have to charge my students. So, I won't use it.*

Original French: *Comme je suis en maths, on nous donne un site qui est payant [Kwyk]. Que l'année prochaine, si j'utilise ce site, c'est facile, je ne peux pas l'utiliser, sinon je dois faire payer mes élèves. Donc je ne vais pas l'utiliser.*

School Leader 0601 – interview excerpt: *The people from AI4T said that it was not usable in an educational context because it was not GDPR compliant.*

Original French: *Les personnes de AI4T ont dit que c'était pas utilisable dans le dans le cadre de l'exercice pédagogique puisque pas conforme au RGPD.*

Teacher 0516_2 – interview excerpt: *It needs to be more specific to each teacher's work, meaning for me, as a maths and science teacher, that they need to help us more in that regard, they need to give us more tools, we know that things change very quickly [...] So if new tools became available, for example for vocational high schools, students could use AI to review homework.*

Original French: *Que ce soit plus spécifique au métier de chacun, c'est à dire moi qui suis en maths/sciences qu'on m'aide un peu plus là-dessus, qu'on nous donne un peu plus d'outils, on sait qu'ils bougent beaucoup [...] Donc si d'autres outils étaient faits, par exemple pour les lycées pros, certainement ils se diraient là avant de réviser leurs devoirs pour être plus près quoi.*

School Leader 0627 – interview excerpt: *I think that if we want the tool to be used by teachers, it has to be conceptualised by teachers. In other words, I think that if a company or a group creates a tool by relying on artificial intelligence only without consulting with teachers, then there's little chance that the tool will be adapted to teachers' needs and used in the classroom. There definitely needs to be teachers on the conceptual development team or as product testers because it's quite complex.*

Original French: *Je pense que si on veut que l'outil soit utilisé par les enseignants, il faut que l'idée vienne des enseignants. C'est à dire que je pense que si c'est une entreprise, une association qui développe un outil quel qu'il soit, s'appuyant sur de l'intelligence artificielle sans consulter les enseignants, il y a peu de chances que l'outil soit adapté et soit utilisé. C'est à dire qu'il faut assurément qu'il y est des enseignants dans l'équipe de développement ou à titre de test ou qu'ils expérimentent pour voir parce que c'est très compliqué.*

Teacher 0524_3 – interview excerpt: *[Marking] takes time, and it is interesting to understand student errors and to look at their levels of achievement. I think we need to continue doing this, but sometimes we might hold back on giving them tests, even formative ones, because it takes time to mark. So, I find tools like AI very interesting in our line of work, because they provide exercises, they grade them, and they give us an overview of students' levels of achievement.*

Original French: *[La correction], c'est la partie qui nous prend du temps et qui est intéressante pour comprendre un peu les erreurs des élèves et voir leur niveau. Je pense qu'il faut continuer un peu à le faire, mais parfois on va peut-être se freiner à leur donner des évaluations, même formatives, parce que ça va nous prendre du temps à les corriger. Alors que justement avec des outils d'assistance comme*



ça, qui proposent des exercices, qui les corrigent, qui nous font un état des lieux, un peu de leur niveau, ben je trouve que ça c'est intéressant dans notre métier.

Teacher 0516_1 – interview excerpt: *Generally speaking, the ability to create a set of exercises on any given topic, that's something that will be of interest to all teachers.*

Original French: *Donc, on va dire globalement être capable de construire une planche d'exercices sur un thème donné, c'est quelque chose qui va intéresser tous les enseignants.*

Teacher 0524_2 – interview excerpt: *If I create digital tools, digital assessment tasks or start to put content into those tools and then the artificial intelligence analyses what's going on, that's very interesting to me.*

Original French: *Si je crée des outils, des évaluations numériques ou que je commence à mettre des choses dedans et que derrière il y a là de l'intelligence artificielle qui essaye d'analyser un peu ce qui se passe, ça m'intéresse.*

School Leader 0627 – interview excerpt: *We know very well that there are different academic levels in any student group, and that's even truer today than it was 20 years ago. So, teachers sometimes divide students based on their very, very different levels. We could imagine having very good students working on their own to a greater extent whilst the teacher spends a bit more time with students with difficulties using tools adapted to their needs. The issue here is that we can't let students get bored. [...] I think that, in any discipline, a tool such as an AI-based app would really contribute to managing students' academic differences in class.*

Original French: *On sait très bien, dans une classe, il y a des niveaux divers et variés, et encore plus qu'il y a 20 ans. Et donc l'enseignant fait parfois le grand écart entre des élèves qui ont des niveaux très très très très opposés. On pourrait avoir de très bons élèves qui travaillent un peu plus en autonomie et l'enseignant pourrait se consacrer un peu plus aux élèves en difficulté et avec des outils adaptés. Parce que le problème c'est qu'il faut pas que certains élèves s'ennuient. [...] Je pense qu'on pourrait gagner sur la gestion, l'hétérogénéité d'une classe, quelle que soit la discipline, grâce à un outil comme une application avec de l'IA derrière.*

School Leader 0530 – interview excerpt: *Just think of the investment! Everything that currently exists comes from either Asia or the United States. AI-ethical tools are being developed as we speak for the general public. But it's true that we would like the Education Nationale to get involved and take responsibility for these tools.*

Original French: *L'investissement. Tout ce qui existe actuellement, ce sont des outils soit asiatiques, soit qui proviennent des États-Unis. Les outils qui se développent maintenant sur le sujet, comme on dirait, pour le grand public. Mais c'est vrai qu'on aimerait bien que l'Éducation nationale puisse s'en saisir.*

Teacher 0608_1 – interview excerpt: *As a teacher, I don't necessarily feel that I have the knowledge or power to say okay, I approve this. I can approve the teaching side of an AI tool, but I'm not sure I can approve anything else. In fact, I don't have any authority over a tool like this. I would need people who are competent with information technology to be able to okay that aspect.*

Original French: *Moi, en tant que professeur, je me sens pas forcément les connaissances et la carrure pour dire ok là je valide. Moi je peux valider le côté pédagogique, mais je ne suis pas sûr de pouvoir valider autre chose. En fait, j'ai pas la prétention sur un outil comme ça. J'aurais besoin d'avoir des gens qui soient compétents d'un point de vue informatique pour pouvoir valider cet aspect.*

Teacher 0606 – interview excerpt: *We need to be presented with this tool and for it to be approved by inspectors to be sure that we stick to the rules, I think.*

Original French: *Il faudrait qu'on nous présente cet outil et que ce soit validé par les inspecteurs. Pour être sûr qu'on reste dans les clous, je pense.*

School Leader 0627 – interview excerpt: *Concerning artificial intelligence, I can't see it, because it's not used that much yet. We will indeed have to consider it as it develops, when we have AI tools, we will indeed have to inform people.*

Original French: *Par rapport à l'intelligence artificielle, non, puisque c'est pas beaucoup utilisé encore pour l'instant. Il faudra qu'on y vienne effectivement, quand ça se développera, quand on aura des outils avec de l'intelligence artificielle, il faudra effectivement qu'on informe.*

Teacher 0628 – interview excerpt: *We might need to discuss or sign, or maybe add to the internal regulations, written consent from students and parents, about the fact that we're going to use artificial intelligence in the classroom, so that its use is approved, or at least made known as a teaching resource and thus accepted by and signed by parents, families, and students.*

Original French: *il y a peut-être à discuter ou à faire signer ou à rajouter peut-être dans les règlements intérieurs, des consentements écrits des élèves et des parents, sur le fait qu'on va utiliser dans le cadre de la classe l'intelligence artificielle, pour que ce soit une utilisation qui soit validée, en tout cas qui soit annoncée comme une utilisation pédagogique et qui soit acceptée de fait par la signature, par les parents, les familles et par les élèves.*

School Leader 0627 – interview excerpt: *Teachers will leave if there's no protection of their own data and of the students' personal data, that's for sure. We see that parents are being increasingly careful about image rights, for example. So you can be sure that with artificial intelligence, they will also be very, very cautious.*

Original French: *Les enseignants, ils vont claquer la porte si y a pas de protection de leurs données à eux et des données des élèves, ça c'est une certitude. On voit, les parents sont de plus en plus vigilants sur le droit à l'image par exemple. Donc vous pouvez être sûr qu'au niveau de l'intelligence artificielle, ils vont aussi être très, très vigilants.*

School Leader 0627 – interview excerpt: *: Where is the data going? What will we do with it? Is it stored? What use does it have? There are quite a few issues here. We work with students who are, let's face it, vulnerable, and who can be easily influenced, and so if we have bad intentions, we can also damage them and that's something that catches teachers' attention and they are very careful with this. So of course, there's a degree of mistrust.*

Original French: *Les données où vont-elles ? Que va-t-on en faire ? Elles sont stockées ? Quelle utilité elles ont ? Voilà, il y a pas mal de choses. Nous, on travaille sur des élèves qui sont on va dire fragiles, qu'on peut modeler assez facilement, et donc si on a des mauvaises intentions, on peut aussi les déformer et ça c'est des choses qui attirent l'attention des enseignants et ils sont vigilants par rapport à ça. Donc oui, il y a une petite méfiance quand même.*

References

- Akgun, S., & Greenhow, C. (2021). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*, 1- 10.
- Anderson, R. E., & Dexter, S. (2005). School Technology Leadership: An Empirical Investigation of Prevalence and Effect. *Educational Administration Quarterly*, 41(1), 49- 82. <https://doi.org/10.1177/0013161X04269517>
- Badia, Antoni, Julio Meneses, Carles Sigalés, et Sergi Fàbregues. « Factors Affecting School Teachers' Perceptions of the Instructional Benefits of Digital Technology ». *Procedia - Social and Behavioral Sciences* 141 (août 2014): 357-62. <https://doi.org/10.1016/j.sbspro.2014.05.063>.
- Banerjee, A. V., & Duflo, E. (2017). An introduction to the “Handbook of Field Experiments.” *Handbook of economic field experiments*, 1, 1- 24.
- Casper, Wm, Bryan Edwards, Craig Wallace, Ronald Landis, et Dustin Fife. « Selecting response anchors with equal intervals for summated rating scales ». *Journal of Applied Psychology* 105 (15 août 2019). <https://doi.org/10.1037/apl0000444>.
- Cave, S., Coughlan, K., & Dihal, K. (2019). 'Scary Robots': Examining public responses to AI. <https://doi.org/10.17863/CAM.35741>
- Céci, Jean-François. « Analyse des pratiques numériques des enseignants, du collège à l'université, au prisme du genre ». *IJARTEch (International Journal of Applied Research and Technology)*, Articles JIP2018, 1 (janvier 2019). <https://hal.archives-ouvertes.fr/hal-01994895>.
- Christensen, R. W., & Knezek, G. A. (2009). Construct validity for the teachers' attitudes toward computers questionnaire. *Journal of computing in Teacher Education*, 25(4), 143- 155.
- Commission Européenne. (2022). *Plan d'action en matière d'éducation numérique (2021-2027)*. <https://education.ec.europa.eu/fr/focus-topics/digital-education/action-plan>
- Davis, F., Bagozzi, R., & Warshaw, P. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35, 982- 1003. <https://doi.org/10.1287/mnsc.35.8.982>
- Deng, R., Benckendorff, P., & Gannaway, D. (2020a). Learner engagement in MOOCs: Scale development and validation. *British Journal of Educational Technology*, 51(1), 245- 262. <https://doi.org/10.1111/bjet.12810>
- Deng, R., Benckendorff, P., & Gannaway, D. (2020b). Linking learner factors, teaching context, and engagement patterns with MOOC learning outcomes. *Journal of Computer Assisted Learning*, 36(5), 688- 708. <https://doi.org/10.1111/jcal.12437>
- Direction de l'évaluation, de la prospective et de la performance, Ministère de l'Éducation national de la jeunesse et des sports et de l'enseignement supérieur, de la recherche. (2022). *Repères et références statistiques*. <https://www.education.gouv.fr/reperes-et-references-statistiques-2022-326939>
- Direction de l'évaluation, de la prospective et de la performance, Ministère de l'Éducation national de la jeunesse et des sports et de l'enseignement supérieur, de la recherche. (2023). *L'indice de position sociale (IPS) un outil statistique pour décrire les inégalités sociales entre établissements, focus sur les collèges*. <https://www.education.gouv.fr/l-indice-de-position-sociale-ips-un-outil-statistique-pour-decrire-les-inegalites-sociales-entre-377738>



European Commission, Directorate-General for Education, Youth. *Final Report of the Commission Expert Group on Artificial Intelligence and Data in Education and Training: A Executive Summary*. LU: Publications Office of the European Union, 2022. <https://data.europa.eu/doi/10.2766/65087>.

« A Definition of AI: Main Capabilities and Scientific Disciplines ». European Commission, High-Level Expert Group on Artificial Intelligence, 2019. <https://digital-strategy.ec.europa.eu/en/library/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines>.

Ertmer, Peggy A., Anne T. Ottenbreit-Leftwich, Olgun Sadik, Emine Sendurur, et Polat Sendurur. « Teacher Beliefs and Technology Integration Practices: A Critical Relationship ». *Computers & Education* 59, n° 2 (1 septembre 2012): 423-35. <https://doi.org/10.1016/j.compedu.2012.02.001>.

Fengchun, Miao, Wayne Holmes, Huang Ronghuai, et Zhang Hui. « AI and education: guidance for policy-makers ». UNESCO, 2021. <https://unesdoc.unesco.org/ark:/48223/pf0000376709>.

Février, F., Gauducheau, N., Jamet, É., Rouxel, G., & Salembier, P. (2011). The study of affects in human-computer interactions: Theories, methods and benefits. *Le travail humain*, 74(2), 183- 201.

Guskey, T. R. (2000). *Evaluating professional development*. Corwin press.

Jang, Y., Choi, S., & Kim, H. (2022). *Development and validation of an instrument to measure undergraduate students' attitudes toward the ethics of artificial intelligence (AT-EAI) and analysis of its difference by gender and experience of AI education*. <https://link.springer.com/article/10.1007/s10639-022-11086-5>

Manon Romain , Romain Imbach , Violaine Morin et Sylvie Lecherbonnier (2023, 11 January). Au lycée, de nouvelles données révèlent l'ampleur du « tri social » entre les voies générale et professionnelle. *Le Monde*. https://www.lemonde.fr/les-decodeurs/article/2023/01/11/au-lycee-les-indices-de-position-sociale-revelent-l-ampleur-du-tri-social-entre-les-voies-generale-et-professionnelle_6157366_4355770.html

Njiku, J., Maniraho, J. F., & Mutarutinya, V. (2019). Understanding teachers' attitude towards computer technology integration in education: A review of literature. *Education and Information Technologies*, 24(5), 3041- 3052. <https://doi.org/10.1007/s10639-019-09917-z>

Noiwan, J., Piyawat, T., & Norcio, A. F. (2005). *Computer Attitude and Computer Self-Efficacy: A Case Study of Thai Undergraduate Students*. 11.

Perrotta, Carlo. « Do School-Level Factors Influence the Educational Benefits of Digital Technology? A Critical Analysis of Teachers' Perceptions: The Educational Benefits of Digital Technology Use ». *British Journal of Educational Technology* 44, n° 2 (mars 2013): 314-27. <https://doi.org/10.1111/j.1467-8535.2012.01304.x>.

Poyet, Françoise. « Perception de l'utilité et usages pédagogiques d'environnements numériques de travail par des enseignants du second degré ». *Sciences et Technologies de l'Information et de la Communication pour l'Éducation et la Formation* 22, n° 1 (2015): 45-64. <https://doi.org/10.3406/stice.2015.1686>.

Remian, D. (2019). Augmenting Education: Ethical Considerations for Incorporating Artificial Intelligence in Education. *Instructional Design Capstones Collection*. https://scholarworks.umb.edu/instruction_capstone/52

Samoili, Sofia, COBO Montserrat Lopez, Blagoj Delipetrev, Fernando Martinez-Plumed, GUTIERREZ Emilia Gomez, et PRATO Giuditta De. « AI Watch. Defining Artificial Intelligence 2.0 », 29 octobre 2021. <https://doi.org/10.2760/019901>.



- Schepman, A., & Rodway, P. (2020). Initial validation of the general attitudes towards Artificial Intelligence Scale. *Computers in Human Behavior Reports*, 1, 100014. <https://doi.org/10.1016/j.chbr.2020.100014>
- Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, 128, 13- 35.
- Schiff, D. (2021). Out of the laboratory and into the classroom: The future of artificial intelligence in education. *AI & SOCIETY*, 36(1), 331- 348. <https://doi.org/10.1007/s00146-020-01033-8>
- Shattuck, G. (2009). Understanding School Leaders' Role in Teachers' Adoption of Technology Integration Classroom Practices. *Educational Media and Technology Yearbook*, 7- 28.
- Suh, W., & Ahn, S. (2022). Development and Validation of a Scale Measuring Student Attitudes Toward Artificial Intelligence. *SAGE Open*, 12, 215824402211004. <https://doi.org/10.1177/21582440221100463>
- Tricot, A. (2020). [Report] Quelles fonctions pédagogiques bénéficient des apports du numérique. Numérique et apprentissages scolaires. https://ecogestion-caen.second-degre.ac-normandie.fr/IMG/pdf/201015_cnesco_tricot_numerique_fonctions_pedagogiques-1.pdf
- Wang, B., Rau, P.-L. P., & Yuan, T. (2022). Measuring user competence in using artificial intelligence: Validity and reliability of artificial intelligence literacy scale. *Behaviour & Information Technolog.* <https://www.tandfonline.com/doi/abs/10.1080/0144929X.2022.2072768?journalCode=tbit20>
- Wang, Y.-Y., & Wang, Y.-S. (2019). Development and validation of an artificial intelligence anxiety scale: An initial application in predicting motivated learning behavior. *Interactive Learning Environments*, 0(0), 1- 16. <https://doi.org/10.1080/10494820.2019.1674887>
- Yennek, N. (2014). Contribution de l'intérêt situationnel à une reconsidération de la satisfaction dans la formation pour adultes [Thesis, Theses.fr]. In *Theses.fr*. <https://www.theses.fr/2014PA100122>

