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Authors (Name and Partner Institution)	Michalinos Zembylas (OUC) Miranda Christou (OUC)
Contributors **(Name and Partner Institution)**	Maria Kasinidou (OUC) Styliani Kleanthous (OUC) Jahna Otterbacher (OUC)
Reviewers	Avital Shulner Tal (UH) Kalia Orphanou (OUC)
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Abstract	
This deliverable presents a multi-modal evaluation of the implemented teacher training, in collaboration with the Cyprus Pedagogical Institute.	
Keyword(s):	Cyprus Pedagogical Institute, Professional training of teachers, Evaluation

Contents

1. Executive Summary

As described in the CyCAT DoA, the OUC CyCAT team partnered with the Cyprus Pedagogical Institute (CPI), to offer specialized training sessions focused on algorithmic literacy in information access systems. The training was offered free of charge to public school teachers in Cyprus, who teach a range of subjects in primary and secondary level. The CPI is the branch of the Ministry of Education in Cyprus, which is responsible for the professional training of all public school teachers, including all certification processes. To maintain their certification, all teachers must enroll each year in continuous education courses offered by CPI, and it is within this context that the CyCAT training entitled "Algorithmic Transparency: The Role of Education" was offered. In particular, teachers could enroll in one of three sessions offered on Saturdays during October 2020 (17th, 23rd, or 31st).

The current deliverable complements D2.3 and D5.1 (Materials for teacher training), which outlined a lesson plan for the sessions and provided information on how the teacher training was carried out. Following the successful completion of the trainings, researchers at CyCAT conducted a questionnaire- and focus group-based evaluation in order to assess: i) changes in teacher attitudes, ii) the extent to which they were able to apply the knowledge gained as well as the taught materials and exercises in their own classrooms, and iii) the extent to which they believe their students will be impacted. Evaluations conducted immediately after the training, with a follow-up after 10 months.

2. Overview of Instructors

The trainings were carried out by Prof. Michalinos Zembylas and Prof. Miranda Christou, who are both graduates of the Pedagogical Institute in Cyprus (i.e., are certified public school teachers) as well as university professors specialized in the science of education, at the Open University of Cyprus and the University of Cyprus, respectively.

Pre- and post-training questionnaires were distributed to the participants who attended the training sessions. These data will be fully analyzed and presented below and will be complemented by a follow-up questionnaire, and a focus group evaluation in order to ascertain the longer-term impact of the training on the teachers' attitudes and practices.

3. Results from the Pre-Training Questionnaire

Here, we present the data from the questions posed in the pre-training questionnaire, in order to provide readers with information concerning the participants' demographic characteristics, as well as their attitudes, understanding and beliefs surrounding algorithmic processes and algorithmic mediation in the information access landscape.

As mentioned in D2.3, although the training sessions were initially offered only for secondary teachers, in early October the decision was taken to open up the training to registered teachers in the public sector, at any level and from any domain / specialization. As can be seen in Figure 1, nearly 70% of participants were women. Figure 2 demonstrates the wide range of subject areas / specializations of the participants,with over one quarter of them being mathematics teachers. It was also interesting to observe that we had some interest from teachers at the primary level, as well as from kindergarten teachers, although they are the minority. The participants were, in general, frequent users of Internet applications. As shown in Figure 3, all respondents indicated

that they used them at least “a few times per day” with most of them choosing the response “very often.”

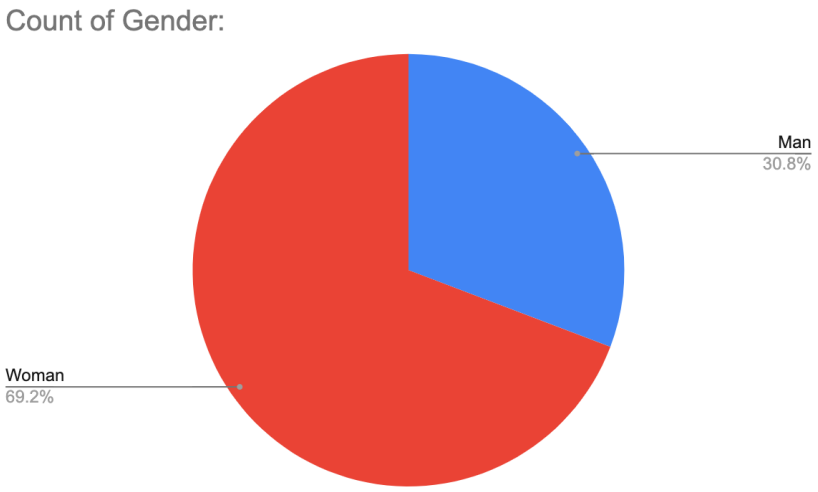

Figure 1: Pre-training questionnaire participants’ gender.

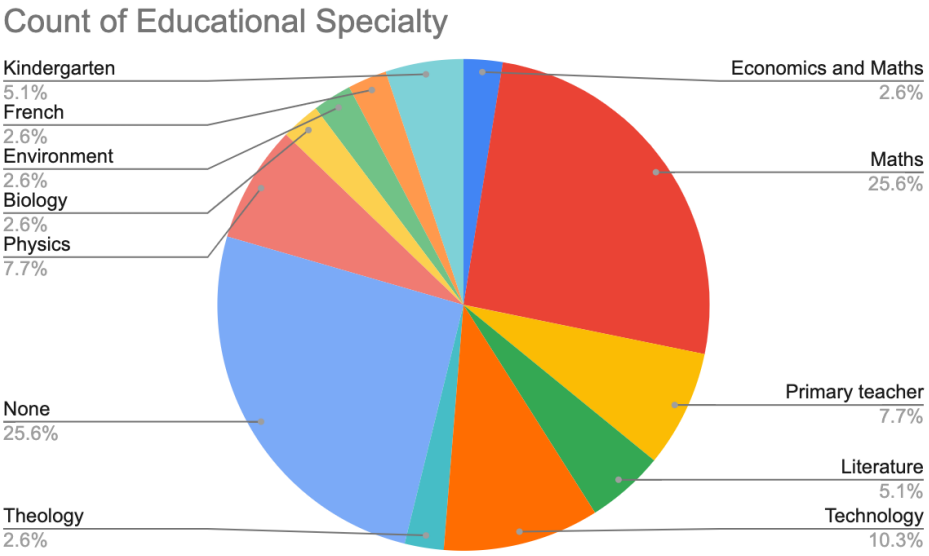

Figure 2: Participants’ area of specialization (if any).

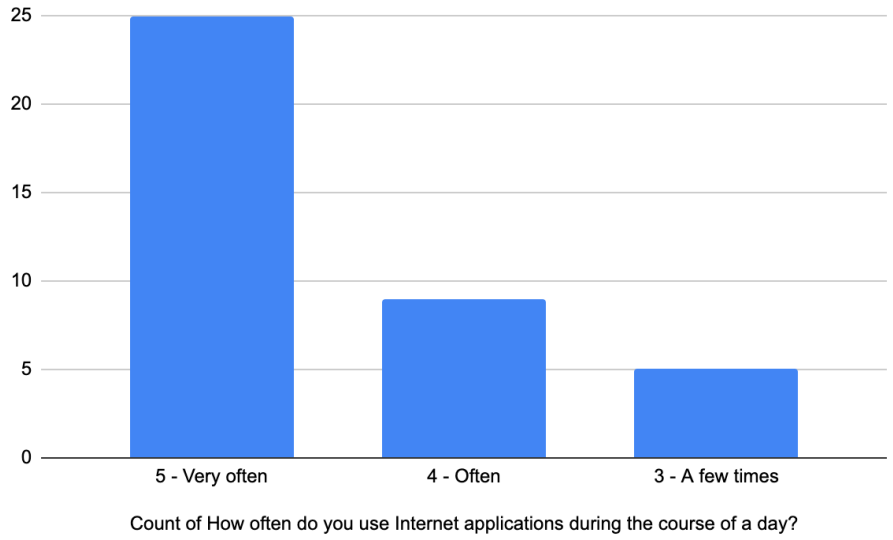

Figure 3: Participants' use of Internet applications on an average day.

Table 1 presents the responses to three questions that aimed to gauge the participants' knowledge and beliefs about algorithmic processes and mediation in information access. In particular, the table presents the proportion of respondents who answered "yes," "no" or "I'm not sure" to the questions / statements posed. The responses demonstrate that while most of the teachers were aware of algorithmic mediation, in that they do not have access to all of the available content within applications such as Web search and social media, they also indicated that they really do not understand how such algorithmic processes work.

	Yes	No	I'm not sure
Do Internet search engines (e.g., Google) present the same results to all users?	0.05	0.70	0.25
On social media (e.g., Facebook, Instagram, LinkedIn), I see all of the posts from my friends / the pages I follow.	0.18	0.69	0.13
I understand how common algorithms in information access systems work (e.g., Facebook news feed, Google search engine).	0.20	0.80	0.0

Table 1: Participants' beliefs about algorithms in information access services.

In Table 2 we can see the responses of the participants in questions meant to examine their overall understanding of the algorithmic processes behind information access systems they use frequently. Participants had to select an option from a five-point Likert scale where 1 indicates Strongly Disagree and 5 indicates Strongly Agree. Their responses show that in their majority (64.1%) they are aware that the applications we use daily are based on an algorithm while in their majority they believe that search engines are language independent (35.9%). A good number of the participants (53.8%) understand that their behaviour and interaction with social media content

affects their future interactions within that platform, however, they do not seem to agree on whether the *"algorithms handle all users in the same way"*. 69.3% of the participants understand that there are social consequences of integrating algorithms into information systems, while 25.6% have selected the middle range of the scale. Clearly, based on the results, there is a need for educating the educators regarding the above topics.

	1	2	3	4	5
Almost all the applications we use in our daily lives are based on an algorithm.	0%	0%	12.8%	23.1%	64.1%
A search engine (e.g. Google) will show me the same results, regardless of the language I use when searching.	35.9%	33.3%	20.5%	7.7%	2.6%
My behavior on social media (e.g. Facebook) affects the content that will be presented to me in the future.	0%	5.1%	15.4%	25.6%	53.8%
Algorithms handle all users in the same way.	21.3%	33.3%	17.9%	15.4%	10.3%
There are social consequences of integrating algorithms into information systems.	2.6%	2.6%	25.6%	30.8%	38.5%

Table 2: Participants' beliefs about algorithms in information access services.

4. Results from the Post-training Questionnaire

40 participants in total replied to the post-training questionnaire. 35 participants answered both pre- and post- training questionnaires (3 participants answered only the pre-questionnaire and 5 participants answered only the post-questionnaire). As can be seen in Figure 3, 70% of the participants were women. Figure 5 presents the different subject areas/specializations of the participants, with 32% of them being mathematics teachers and 12% primary school teachers. It was also interesting to observe that we had some interest from pre-primary level, as well as from teachers in disciplines other than computer science, although they are the minority.

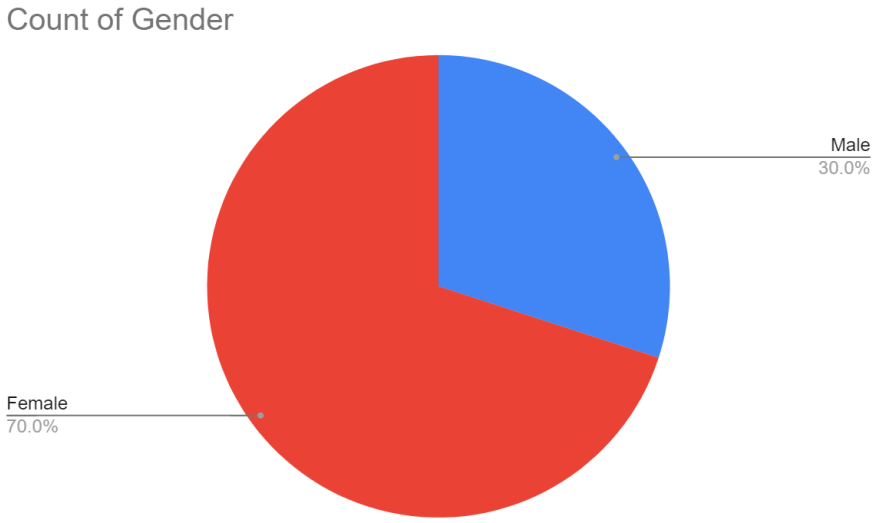

Figure 4: Post- training Questionnaire participants' gender

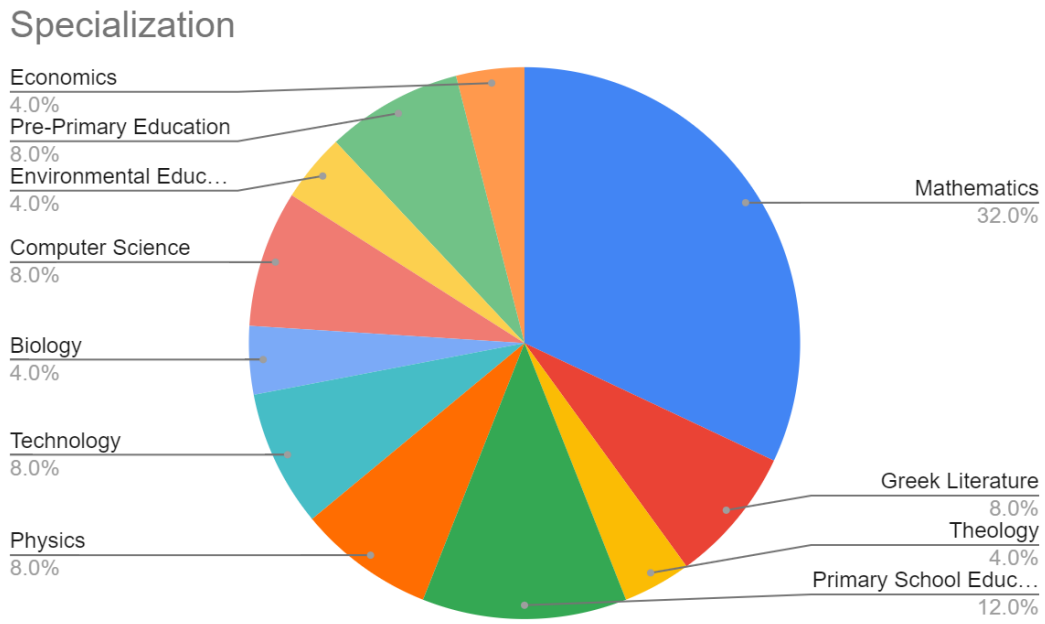

Figure 5: Participants' area of specialization (if any)

4.1. Training Evaluation

One of the purposes of running the post-seminar questionnaire was to evaluate the training in terms of its clarity, objectives, format etc. Similarly to above, participants had to select an option from a five-point Likert scale where 1 indicates Strongly Disagree and 5 indicates Strongly Agree. Table 3 presents the responses to the questions that aimed to assess the training. Overall the evaluation was positive with 72.5% of the participants rating the structure of the training as being clear and efficient and 92.5% stating that the training met their expectations. The educational material and content appear to be understandable and accessible for 100% of the participants, with 97.5% stating that *"the training is useful for all educators"*. Most importantly 97.5% of the participants think that *"The training made good connections between technical information and the social dimension of using algorithms"*.

	1	2	3	4	5
The structure of the training was clear and efficient	0%	0%	2.5%	25%	72.5%
The educational content and material of the training was understandable and accessible	0%	0%	0%	20%	80%
The objectives of the training were related to the broader pedagogical objectives of the school	0%	0%	12.5%	37.5%	50%
The training provided opportunities for interactive learning	0%	0%	7.5%	27.5%	65%
The training is useful for all educators	0%	0%	2.5%	32.5%	65%
The training made good connections between technical information and the social dimension of using algorithms	0%	0%	2.5%	30%	67.5%
The training met my expectations	0%	0%	7.5%	30%	62.5%

Table 3: Participants' evaluation of the training

4.2. Educational Content Evaluation

An also important goal of this study was to evaluate the educational content used during the training. We were particularly interested to understand whether the activities and examples provided to the teachers will be easily applicable in the classroom and their effectiveness in helping students to understand the algorithmic function in general and how social media and search engine interaction behaviour affect the content they will be interacting with in the future. Participants had to select an option from a five-point Likert scale where 1 indicates Strongly Disagree and 5 indicates Strongly Agree. Table 4 provides more details on how participants evaluated the educational content of this training. Specifically, 72.5% selected choices 4 and 5 in the 5-points Likert scale, indicating that the educational material used in the training *"is easily applicable in the classroom"*. 90% of the participants believe that *"applying the knowledge they gained from the training to the classroom would help students understand the algorithmic function"*.

The training activities emphasized one of the most frequent problems of information consumption in social media and search engines, the "Filter Bubble". Thus, we asked participants whether the activities used are useful for understanding the algorithmic function in general and whether they would be easily accessible in their class. 92.5% and 72.5% respectively responded positively, indicating that the activities on Filter Bubble will be able to help students understand the algorithmic function and the teachers in their majority will be able to use those in class. There were some teachers (27.5%, 11 participants), who due to the subject they teach expressed their reluctance to use these specific activities in class. However, in their majority (8 out of 11) they agree that the activity serves the overall purpose of understanding how information access mediating algorithms work. Finally, the majority of the participants agree that with specific activities in their classroom they could influence the behavior of their students during their interaction with social media and search engines (72.5% and 82.5% respectively).

	1	2	3	4	5
The educational material of the training is easily applicable in the classroom	0%	5%	22.5 %	47.5%	25%
Applying the knowledge I gained from the training to the classroom would help students understand the algorithmic function.	0%	0%	10%	50%	40%
"Filter bubble" is a useful activity for understanding algorithmic operation	0%	0%	7.5%	32.5%	60%
The "filter bubble" can be easily shaped and applied in the classroom	0%	2.5%	25%	35%	37.5%
With specific activities in the classroom I could influence the behavior of my students during their interaction on social media (eg Facebook).	0%	2.5%	25%	35%	37.5%
With specific activities in the classroom I could influence the behavior of my students when they interact with search engines (eg Google).	0%	2.5%	15%	47.5%	35%

Table 4: Participants' evaluation of the educational content.

4.3. Participants' Knowledge Evaluation

It was also important for us to briefly examine whether the knowledge they gained through this training will influence their own behavior when they interact with information access systems. Overall, the majority replied positively by selecting the highest positive choices in the scale (1 indicates Strongly Disagree and 5 indicates Strongly Agree). Table 5 provides an overview of the results.

	1	2	3	4	5
The knowledge I gained from the training will influence my behavior during my interaction on social media (e.g. Facebook).	0%	2.5%	10%	37.5%	50%
The knowledge I gained from the training will influence my behavior when interacting with search engines (e.g. Google).	0%	2.5%	12.5%	27.5%	57.5%

Table 5: Participant's knowledge evaluation

5. Results from the Follow-up Questionnaire

A follow-up study was run eight months after the training with the aim to evaluate the: i) knowledge teachers gained after the training in the long term, ii) the use of the proposed activities in their own classroom, in the months following the training and iii) their keenness in recommending this training to their colleagues. Participation was voluntary and 15 participants replied. We followed a similar approach as with the previous two questionnaires. We presented the participants with a number of statements and asked them to rate them following a five-point Likert scale where 1 indicates Strongly Disagree and 5 indicates Strongly Agree. An open-ended question was also added asking: *Please explain why you did not use any of the activities provided during the training in your curriculum.* Overall, 100% of the participants indicated that they would recommend this training to their colleagues.

5.1. Participants' Knowledge Evaluation

In Table 6 we can see the participants' responses regarding the knowledge they believe they gained after the training. 100% of them are *"able to better understand the behavior of information systems such as social media and search engines"*, while 93.3% indicated that they were feeling more confident in explaining to their students how their interaction with content in information access systems affects what they see on the internet. It is evident also in this occasion that teachers had difficulty in applying some of the knowledge they gained in the classroom. Although in their majority (53.3%) they replied positively in the statement *"Applying my knowledge in the classroom helped the students to understand the algorithmic function."* 20% selected the lower end of the scale.

As mentioned earlier and according to the participants' replies in the open ended question this was mainly due to the different subject specializations of the teachers involved in this questionnaire and the COVID-19 restrictions that added additional obstacles in meeting physically in class and restricting the in-class time for extracurricular activities. 93.3% however,

indicated that the knowledge they gained from the training influenced their behavior and interaction with information access systems such as social networks and search engines.

	1	2	3	4	5
After attending the training I am able to better understand the behavior of information systems such as social media and search engines.	0%	0%	0%	66.7%	33.3%
After attending the training I feel more confident to explain to my students how their interaction with specific content in information systems affects the content they see on the internet.	0%	0%	6.7%	53.3%	40%
Applying my knowledge in the classroom helped the students to understand the algorithmic function.	20%	0%	26.7%	33.3%	20%
The knowledge I gained from the training influenced my behavior during my interaction with sources of information through social networks.	0%	0%	6.7%	53.3%	40%
The knowledge I gained from the training influenced my behavior during my interaction with sources of information through search engines.	0%	0%	6.7%	53.3%	40%

Table 6: Participant's responses for knowledge gained after the training

5.2. Evaluation of Activity Inclusion in the Curriculum

Based on the replies we received in the post-training questionnaire and also from the previous section, teachers found it difficult to incorporate activities related to the training's themes in their curriculum. 53.3% (8 out of the 15 participants) have incorporated at least one activity that was provided during the training into their curriculum, while 46.7% didn't. Out of the 8 participants who incorporated at least one activity in their curriculum 4 of them believe that the *"filter bubble activity was easily configured and implemented in the classroom"*, while the others selected the middle value of the scale (3) - see also explanation above. Although not all have incorporated the specific activities provided during the training in their curriculum, a number of them indicated that with other activities they believe that the behavior of their students was influenced by their interaction with sources of information through search engines (66.6%) and social media (70%). Table 7 provides a detailed presentation of the results.

	1	2	3	4	5
I have incorporated at least one of the activities provided during the training into my curriculum.	6.7%	20%	20%	33.3%	20%
I am able to incorporate the knowledge I gained during the training into classroom activities	0%	0%	20%	53.3%	26.7%
The filter bubble activity was easily configured and implemented in the classroom	20%	13.3%	33.3%	33.3%	0%
I was able to engage in discussions with my students about the filter bubble effect	20%	13.3%	20%	33.3%	13.3%
With specific activities in the classroom I believe that the behavior of my students was influenced by their interaction with sources of information through social networks.	20%	13.3%	6.7%	46.7%	13.3%

With specific activities in the classroom I believe that the behavior of my students was influenced by their interaction with sources of information through search engines.	20%	6.7%	6.7%	53.3%	13.3%
My students seemed to be interested in the activities	13.3%	26.7%	26.7%	6.7%	26.7%
My students were surprised by the Filter Bubble phenomenon in information systems	33.3%	33.3%	13.3%	6.7%	13.3%
My students knew about the Filter Bubble effect	66.7%	26.7%	0%	0%	6.7%
My students knew about personalization in systems	60%	26.7%	0%	6.7%	6.7%

Table 7: Participant's Activities Evaluation and inclusion in the curriculum

6. Results from the Focus Group

Our team conducted two focus groups on Thursday, 16/9/2021 and Wednesday, 29/9/2021. In both groups we had a total of six teachers participating. In the conversations we had with teachers, they reiterated their appreciation for the CyCAT training they had received and explained some of the challenges they faced in implementing the pedagogical activities we had shared with them during the training.

First of all, they emphasized that although the activities were valuable, it was difficult to integrate them in the curriculum because of limited time, but most importantly, because their curriculum was prescribed to a large extent and they were pressured to cover certain teaching material. For this reason, they suggested that CyCAT activities would have more chance to be implemented, if they were somehow included 'officially' in the curriculum of a specific subject matter (e.g., computer studies). This is a well-known challenge in the literature on teaching and teachers (also in Cyprus) that sometimes reflects reality to a large degree, while other times it is used as an excuse by teachers to cover their unwillingness or lack of support to implement a new idea. The fact of the matter is that these teachers' concerns were also reflected in the results from questionnaires regarding the extent to which teachers actually implemented our training material. From our experience too, unless there is some sort of policy guideline that encourages or rewards teachers for implementing a new idea, it is difficult for them to do so, as there are many initiatives taking place in schools and teachers are bombarded from everywhere to do a lot of things.

7. Conclusion

Overall, the workshops provided a rare opportunity for teachers to explore questions of algorithmic transparency. The feedback from all the sessions was that this is an innovative, cutting-edge topic that is not covered by regular in-service training. It should also be noted that the use of the term "algorithmic transparency" was foreign to some educators.

Additional issues to take into account in terms of expanding awareness through educational systems are the following:

1. Teachers pointed out that algorithmic transparency is relevant for both primary and secondary levels of education. They also noted that it is an issue that comes up in different courses (Math, Science, History and even Art class) so they believe that all teachers need to have a basic grasp of the phenomenon and ways to raise awareness about the use of algorithms in search engines.

2. Teachers appreciate the availability of manuals which provide ready-made material (activities, handouts) to use in the classroom along with suggestions for age-appropriate exercises.

3. In educational systems with high levels of curriculum centralization (as in the case of Cyprus) interventions should also be targeted at higher levels of decision-making hierarchy.