TE_REG Report WP2a2 / UCLL & KUL

GenAI and its implications for teacher education in Flanders: integrative report

Integrative research report on GenAI and its implications for teacher education in Flanders by the joined forces of KU Leuven and UCLL

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Introduction

This report was developed within the framework of the TE_REG project, an Erasmus+ co-funded initiative and focusses on the situation in Flanders. The project explores two major challenges facing contemporary teacher education. On the one hand, the rapid development of Generative Artificial Intelligence (GenAI) challenges established practices in teaching and learning. On the other hand, the emphasis on competency-based teacher standards and its implication for teacher education.

For the challenge of GenAI, first an exploratory literature review was performed to explore how the Flemish educational system interacts with GenAI and how it deals with the challenges that go along. This review included both analogue and online academic and popularized literature, policy documents, legislative texts, and program guides. Findings were reported in the exploratory report (WP2a1).

Next, we worked towards this integrative report (WP2a2). For this report we collected input with focus group discussion on the use of GenAI and its implications for both initial teacher education (pre-service) and professional development (in-service). Two rounds of focus group discussions were organised. On January 15th, a focus group discussion was conducted with teacher educators from the Master of Teaching programme in Behavioral Sciences (N=13), divided into two smaller groups. This session provided valuable input and served as a kind of trial run. On January 29th, four separate focus groups were held, each consisting of 6 or 7 participants (N=25), all personally invited. These groups brought together a diverse mix of (Gen)AI experts, educational specialists, teacher educators, and student teachers from both educational bachelor's and master's programmes and with expertise in primary as well as in secondary education. The first part of this integrative report is the result of these discussions. In the second part we articulate our standpoints on the future practice and policy.

For the challenge of competency-based teacher standards a similar approach was followed. This is discussed in the report WP2b1 en WP2b2.

Part 1 : Outlines of the focus group discussions on GenAI

1) What are the implications for learning and the learner?

Overall, a prevailing view from the focusgroups was that learners will need to learn how to work with GenAI. While GenAI is capable of producing a wide range of outputs, meaningful learning necessitates intense, active engagement (hard thinking) from the learner. It is therefore crucial that learners understand the necessity of their own active involvement in the learning process when using such technologies.

This has major implications for the learner, as the integration of GenAI in educational settings requires individuals not only to formulate appropriate prompts, but also to critically monitor their own learning processes and make informed decisions about how, when, and to what extent GenAI should be utilised.

2) What are the implications for teaching and the teacher?

In general, the respondents agreed that the presence of GenAI can and will affect the role of teachers as well as the needed teaching competencies.

The focus group discussions revealed that it is not possible ("It is too early and too complex.") to fully determine all relevant implications of GenAI for the teaching profession within the scope and timeframe of the sessions. Several participants recommended allocating time to either develop such framework of relevant skills and attitudes, or to identify a comprehensive knowledge base on the GenAI-related competencies teachers will need, referring, for example, to the UNESCO AI Competency Framework for Teachers (Miao & Cukurova, 2024).

Many discussions called for a fundamental reflection on what constitutes the core of (human) teacher professionalism, given the emergence of GenAI. A prototypical example of teacher professionalism is the issue of lesson preparation. Some participants advocate that lesson preparation lies at the very heart of the teaching profession. Engaging in the design process enables teachers to anticipate and respond appropriately to students' questions, difficulties, and needs. According to this view, it is difficult – or for some, impossible – to teach a lesson prepared by someone/something else. GenAI, at most, could serve as a source of inspiration, but the essential work remains for the teacher. Others contend that starting from a given, high-quality lesson plan can help teachers to focus their time on preparing to react to different situations or reactions during class and to fulfill their social-emotional role. It relieves teachers from the need to select appropriate content, design engaging exercises, and create instructional materials from scratch. In this line of thought it is important that the teacher possesses

the capacity to critically evaluate the quality of the lesson plan, in essence the quality of the content and the educational activities, as well as to adapt the plan to the specific classroom context and emerging situations during teaching. This implies that even with a well-prepared lesson plan, not every teacher is suited to teach everything. The teacher retains professional responsible, much like a car driver (with a driver's license) remains accountable, even without understanding of how the engine works.

With regard to lesson preparation, some participants suggested that GenAI could serve as a model for how to prepare a lesson. In a blink of an eye, GenAI can generate multiple versions of a lesson, offering student-teachers an opportunity to learn from these examples. In this sense, GenAI functions as a generator of worked-out examples, which may support the development of lesson design skills. Others, however, expressed doubts about the feasibility and desirability of this approach. A comparison with becoming a carpenter was made. If you want to become a carpenter, you can mimic what the carpenter does and, in the end, you will become a professional carpenter. In our case, a student could mimic GenAI but because GenAI lacks genuine expertise, this imitation is neither pedagogically safe nor sufficient. Currently, the quality of the output of GenAI is not guaranteed which makes is unsafe to copy. In addition, copying without knowing the reasoning, does not guarantee the development of sound professional judgment or expertise.

Connected to the core of the professionalism of the teacher is the role of the teacher in times of GenAI. There is a diversity of opinions on the future role of a teacher: from being replaced by GenAI to becoming unreplaceable in stimulating students to think critically and guiding them in asking the right questions. Some participants suggested that the educational aspects of acquiring content will be done by GenAI. Teachers will be involved in developing learning tasks that challenge students to excel or to gain pride, e.g., for student in behavioural sciences training an animal to do specific tricks. Others expressed concerns that the role of the teacher might be reduced to that of a mere implementer, rather than an active designer of learning experiences—someone who makes thoughtful, deliberate, and critically informed pedagogical decisions. Such a development would render student learning highly vulnerable within a capitalist educational environment, particularly when commercial tools are adopted without sufficient insight into how they were developed, what data they were trained on, and how they handle user data. The lack of transparency surrounding these systems raises significant ethical, professional, and pedagogical concerns.

Identifying the core of teacher professionalism would also help in the societal appreciation of the teaching profession. Some fear that societal appreciation will diminish as part of the profession can be done by GenAI. Others argue that the

educational-didactical expertise remains necessary, to be able to react appropriately on the spot on what is happening in the classroom. This expertise will add to the societal appreciation.

A way to organise a thorough reflection on teacher professionalism could be for teacher-educators to work together with in-service-teachers and external stakeholders to identify what teachers and teacher-educators really need to be able to do (must, should, could, would) in times of GenAI. These results will help teacher education to focus their energy and competence. Pooling efforts and insights seems to be a good idea.

For example, it was also noted that within the Flemish government, a distinction is made in AI professionalisation initiatives for 'government staff' and for 'education staff'. On the website for government staff, there are interesting free AI courses that could also be taken by teachers and that currently stay unknown to the education staff. Forces could be pooled to take even more advantage of each other's effort and in this way follow the directive to create networks (Alen et al., 2023).

Despite reservations about the overall set of necessary competencies, some essential elements were listed for teachers and for teacher trainers, as discussed later on.

3) What are the implications for schools and school organisation?

Opinions on the future organisation of education are very divergent. For example, a respondent suggests that the educational aspects of acquiring content will be done by GenAI. Teachers will be involved in developing tasks that challenge students to excel or to gain pride, e.g., building an operational rocket in physics.

For professionalisation in schools, some suggestions were made

- A possible valuable way to train teachers could be via 'media coaches', a current practice in Flanders. Media coaches are teachers who received additional training on specific ICT approaches and tools. They help other teacher to find their ways in using GenAI (or other ICT tools) in their classes and their preparatory work.
- Professional learning communities could also help teachers in developing develop new practices.
- The implementation of teacher design teams at school level could also be a way to professionalise teachers, where each teacher has own strengths.

4) What are the implications for the curriculum?

The most obvious implication for the curriculum is said to be the integration of AI literacy. Knowing more about AI, what it can do, what the ethical, political and ecological constraints are and how one can deal with them, seems to be evident new curricular goals. Moreover, AI also changes a lot of topics: drawing also becomes drawing with AI, writing also becomes writing with AI, programming also becomes programming with AI, and so on.

There seems consensus that critical thinking becomes more important. It is essential that learners learn how to use AI in a critical way, in order to keep control over AI rather than to become controlled by AI.

Far less evident is the question of whether some curricula are still relevant. Given that GenAI can do many of things as well as a human, the question aises as to whether it is still productive to learn all these things. Much more thought needs to be given to this, as not all the consequences can yet be foreseen.

5) What are the implications for society?

Respondents claim that there is a need for societal awareness of the existence and impact of GenAI. It does not always seem to be very present.

In addition to changes in teacher education, the whole educational community should adapt to the new situation, including the umbrella organisations (called “koepels”), educational administration, …

It is not GenAI itself that is transformative, but the way we use it. And even if teachers do not use it, students will, and it is important that teachers know that.

6) What are the implications for teacher education?

Different learning outcomes for teacher education were identified, without agreement of all participants that they all should be included:

- Acquiring basic knowledge about GenAI. It is important for student-teachers to know how GenAI works, what it can do and cannot do. If students understand the logic of GenAI they can better assess the value of the output. It will help them to understand that they should not use GenAI to look things up because there is no guarantee that the information is correct. They need to understand that GenAI is an algorithm. Currently, many teachers do not know the power of GenAI and

under- or overestimate its power, according to some participants in the focus groups.

- Developing digital literacy, including media literacy, and ICT competencies, taking into account the ethical, deontological, and ecological implications of GenAI and to use the tools and digital media accordingly.
- Daring to work with GenAI. It is important that students try it out and gain experience with it.
- Acquiring competencies to work in teams, with other teachers, and with GenAI as an assistant
- Acquiring competencies to work interdisciplinary
- Developing a profound domain-specific knowledge base (cf. Altman: knowledge in depth and breadth). Such a profound knowledge base is necessary to be able to assess the output of GenAI, to make a distinction between sense and nonsense. The knowledge base of the student-teacher should be deeper and broader than that of the students they will teach. It is also important to distinguish between information and knowledge. One can look up information but that does not imply that it will automatically lead to knowledge.
- Developing critical thinking, to develop a critical and open attitude, a willingness to check answers, to assess the quality of on output and to improve or adapt it.
- Developing competencies concerning the emotional and social aspects of teaching.
    a. The development of the pedagogical-didactical skills of a teacher becomes more important as these skills will be the added value of the teacher.
    b. The ability to use data from AI (learning analytics) and to link it to more intangible but important things, like motivation will be at the core of the role of a teacher.
- Developing the personality of the teacher, teaching is more than what the teacher does. Who the teacher as a person is, also has an impact. Educational behaviour can be taken over by GenAI but personality cannot.

This implies some specific competencies of teacher-trainers. Teacher trainers need to be able to show what can be done, they act as exemplars for the student-teachers. They need to master all the competencies mentioned above.

Implications for the approaches to teacher education and teacher professionalization were als suggested, some very broad, some very detailed. They are listed here, with an explanation of their significance. Suggestions about similar competencies are clustered. Not all suggestions follow the same line of reasoning and some even contradict each other.

- Teacher education and professionalization should focus on changing our habits in class, with pupils, in what we do and expect from pupils. GenAI urges us to change our practices.
- In order to stimulate to work interdisciplinary, teacher education could start to work interdisciplinary. This will help students to broaden their view and gain knowledge in 'breadth'.
    - A way to do it could be to let students work together in interdisciplinary teams (teams of teachers of different subjects), and have GenAI act as one of the team members.
- To gain insight into GenAI and to learn how to work with it (and not be afraid of it), several suggestions for teacher education were made:
    - Develop a professional learning community on GenAI in education
    - Stimulate students to experiment with GenAI
    - Give compulsory basic training in GenAI: what is it? What can do it? What not? What can you do with it? In the training attention is paid to learning to look critically at the output and at the commercial and ethical side of the tool, and to see if the tool is available for all students (or even more, that some tools are more available for some specific students, e.g. for students with learning difficulties)
    - Train students to use GenAI as an assistant and not a replacement for the teacher
    - Train students to use GenAI as a way to model learning and to facilitate differentiation
    - Pay attention to the positive aspects of GenAI: you can give routine tasks to GenAI (e.g. adapt the layout of certain exercises, look for examples or suitable pictures, adapt the difficulty of the language. This makes time free for other aspects of teaching, like social interaction, and differentiation, …
    - Make students think about what it implies if you upload tests of students, with the inclusion of their names and other personal data
    - Give students the task to formulate a vision on the use of GenAI (e.g. vision text on responsible use of GenAI in education.
    - Make a separate module on GenAI for each level of teacher education (also for kindergarten teachers)
    - Overall, the respondents were convinced that teachers who proficiently use GenAI will outperform teachers who do not use GenAI, because GenAI can adapt easily to the needs of a student, faster than a teacher can. The scale of differentiation is not possible for an individual teacher and therefore a teacher using GenAI can better adapt to the student needs and improve student learning.

- Teacher education could differentiate between different profiles in teachers, e.g. more content-oriented, more assisting, more supervising, … This could be a way to develop the personality of the teachers. Depending on the profile the expected use of and expertise in GenAI could differ.
- Teacher education should train students-teachers to really focus on the learning goals and make sure that they stimulate their students towards that goal and assess them accordingly. Often, it will be the reasoning of the student that is more important than the product. Changes in assessment approaches will be apparent
- Teacher education should keep on devoting attention to basic principles of learning, to allow student-teacher to assess the output of GenAI and to react appropriately to situations in class.
- In teacher education, as well as in education, one-on-one conversations between students and teachers will become more important, because it is a way to assess students' understanding.

Part 2 : (Towards) a clear, firm, own position on GenAI

Introduction

The possibilities of GenAI are vast, and its consequences are not possible to predict (as AI permeates down to the smallest details). Nevertheless, we'll try to highlight some consequences.

1. What are the implications for learning and the learner?

What is needed for learning will not change because of the existence of GenAI. The learner will have to do active processing of information, make connections with, and build on prior knowledge, and learning will happen in connection with others in a social situation. The context in which the learning happens and the possible support or hindrances for those essential activities might change. For example, for a learner, doing an exercise is still a good way to process information; asking GenAI to do the exercise and write down the answer takes away mental activity; asking GenAI to correct or give feedback on the answer and reflect on the feedback stimulates cognitive activity.

What needs to be learned will change partly because of the existence of GenAI. The desired learning outcomes will change. At least four changes or points of attention concerning learning outcomes pop up:

- GenAI-literacy will be an important learning outcome, including critical thinking
- The learner's disposition to direct learning activities will be important (most likely more important than today as temptations are very accessible)
- In a field of specialisation, an extended knowledge base will become important (in order to critically assess the quality of the output of GenAI).
- The importance of certain skills will diminish: e.g., writing an eloquent text yourselves might become 'writing an eloquent text with the help of GenAI', or typing without mistakes, will become less important.

For the learners, GenAI has a profound impact. The fact that a machine can do things better or faster than the learner (and often the teacher as well) can be frustrating and impede the will to learn, to motivation to learn. The learner will have to learn to cope with that frustration and maintain a willingness to learn. Learning remains important in order to understand the world and what GenAI is doing.

In addition, and closely related but different, the learner will need a metacognitive disposition to direct one's own learning, to engage in effortful learning activities in view of bringing about learning. In some instances, it might be possible to avoid the effort of

learning by tricking the system. For learning to happen, it is important that the learner remains instructionally obedient and engages in the essential learning activities. The learner needs to develop, in the context of highly intelligent GenAI, the desire to learn, to be able to do things oneself. The idea that learning is demanding and asks for a cognitive engagement should remain.

2. What are the implications for teaching and the teacher?

The possibilities of GenAI change some of the intentions of teaching, the desired learning objectives and broad objectives of school (see above).

The possibilities of GenAI do not change the fundamentals of what teaching is about, that is, creating an environment in which the desired learning process can take place. We therefore consider teaching in the broad sense of education, cf. the four pillars of education as described in the UNESCO report of the International Commission on Education for the Twenty-first Century (Delors, 1996), even if we focus on cognitive learning processes. However, GenAI has huge consequences for the ways learning is supported, and therefore for the enactment of the support. As always, teaching starts from the learning objectives, followed by the question of how to stimulate the desired (often) cognitive activity in relation to that objective. In addition, the possibilities of GenAI to support learning have to be taken into account, as GenAI offers a wide range of possible support for the learner (and the teacher).

We envisage that teaching will be a combination of GenAI-bots and teacher-led activities. Hence the GenAI bot will be more than a learning medium but an environment in itself.

In primary education in particular, we assume that GenAI-bots will be increasingly used for the acquisition of basic knowledge.

For specific (cognitive) learning outcomes (e.g. being able to add and subtract from 0-20 or apply the cognitive dissonance theory in a case), a (high quality- state of the art) GenAI -teaching bot will be developed.

- The bot guides the learner towards the intended learning outcomes, with specific tasks for the learner, and is adaptive to the answers given by the learner.
- The bot is “fed” with literature on education in general (PK: pedagogical knowledge, learning processes, mediation characteristics, cognitive functions of the learner) and education on the specific topic (PCK: pedagogical content knowledge) and with content knowledge of the topic (CK: content knowledge). The bot is developed by a known provider in order to guarantee quality and to reduce

the ecological footprint (if all individual teachers would do it themselves). A school can purchase such bots similar as they buy books.

- The bot adjusts based the input of the learner and of the teacher. They give input that supports the bot to mediate appropriately. The teacher needs advanced educational-didactical expertise in order to give the relevant information to the bot.
- The teacher, considering data from learning analytics, selects together with each student the learning outcomes of the day/lesson and follows up. The teacher is present when the students work and helps when necessary.
- To conclude the learning with the bot, the learners come together and discuss what they learned. Under certain circumstances it might remote/online but in most cases it will be in person.
- Assessment will sometimes involve the use of GenAI and sometimes not.

For other learning outcomes, the teacher guides the learning without a GenAI-bot. During such activities, the learners do not use an electronic device to learn. In this sense, GenAI will optimise the time with the students, making time available for processes and attention.

Teachers will continue to play a critical role in the learning of the learners and the day-to-day activities of schooling in general.

The way they perform this role will partly change.

- A part of the cognitive learning outcomes will be mainly taught by the GenAI-learning bot. The role of the teacher, in addition to the bot, is to identify learning opportunities for the learner, to guide and motivate the learner (e.g. to put effort into the tasks, to praise the learner who has concentrated for a long time, ...). The role as a designer for learning environments for basic learning outcomes will decrease. The teacher will continue to set the goals (in cooperation with the learner).
- The teacher works towards a supportive classroom climate (for learning and for social behaviour).
- Some of the challenging learning outcomes, such as social skills, moral development, interaction with people (e.g., growing a plant, developing empathic relationships with elderly people in an elderly home) will be led by the teacher, who needs to have excellent didactic skills and content knowledge to support and guide the learner.

3. What are the implications for schools and school organisations?

Schools will remain to exist and will be organised in some kind of groups. It will not be necessary that all learners learn the same thing at the same time. The group will be the social environment where learners feel at home and are motivated to learn. In the group they will develop their social skills and co-create new realities.

In the future,

- Schools will have a strategy for purchasing the most appropriate GenAI-teaching bots for the learning outcomes.
- They will have support systems and infrastructure for their teachers to use the GenAI-bots and, most importantly, to motivate learners to continue using the bot, and organise the class climate around it.
- Schools may have GenAI systems that monitor the learning of all students, that help to form class groups, that provide learning plans at yearly, semesterly, weekly and lesson level, that tailors the learning environment to the specific needs and abilities of students, taking into account national curriculum requirements, didactic principles, pedagogical insights, social constraints, ...

They will have support systems and infrastructure to support the learning of the complex learning outcomes.

4. What are the implications for the curriculum?

Some intended learning outcomes will disappear.

There will be more time (needed) for others

- In depth content knowledge
- AI-Literacy / critical thinking

The prominence of GenAI with its important cognitive perspective will highlight the critical nature of pedagogical goals in the domain of metacognition, motivation, social relationships, affection, physical fitness, and well-being.

The impact on the curriculum of primary schools is predicted to be low (focus on basic skills and knowledge: literacy, numeracy, social and physical skills). However, as discussed above, the impact on how the learners learn, will change enormously. The impact on the curriculum in secondary schools will be greater, partly because pupils will have more agency. The impact is threefold: more attention for GenAI, changes in the curriculum given that GenAI will play a role (and need to be addressed) in all subjects, and the relevance of some subjects will increase (e.g., ICT literacy, behavioral sciences)

while others may become less relevant for large groups of students (e.g., drawing). In higher education the impact may be greatest, especially in fields that rely heavily on (the production of) verbal information and interactions.

The need for critical thinking will be widely recognized, and curricula will be confronted with the situation that GenAI knows more than anybody can know, while in order to be able to critically judge what GenAI produces, one needs to know at least as much as what AI knows. This probably will result in the need for highly specialized programs on the one hand and more attention for a critical disposition rather than simply the competence to be critical.

5. What are the implications for society?

GenAI urges us to reflect on the goals of education. This implies a reflection on the cognitive goals of education, but also on the social role of schools/education, e.g., what is the role of schools in the development towards equal opportunities, sustainability, or citizenship.

In general, however, the broad functions of schooling will remain (socialisation and personification).

6. What are the implications for teacher education?

Teacher education will have to prepare teachers for this new situation. Teacher education will therefore aim at

- To be an excellent didactician who understands what a learning process requires (educational-didactical expertise to guide the learner and to give the relevant information to the bot) and who can act accordingly. This also included assessment.
- To be able to guide the learning process in the fieldof “learning to be” and “to live together” (Delors, 1996).
- Developing a disposition to work together as a teacher.
- To have a disposition to work with GenAI appropriately (thorough understanding of how GenAI works, willingness to use it, critically think about when to (not) use GenAI, critically assess the output, ...).
- To have a profound knowledge base in the subject of teaching (with the possibility and openness to work interdisciplinary).

In teacher education attention will be paid to the reciprocal role: the teacher will learn from the student (teacher & pupil, teacher-educator & student-teacher).

Conclusion

The relatively recent availability of GenAI raises many questions, and it is difficult to foresee all the implications. That is due to the continuous evolutions in GenAI itself (what seemed impossible yesterday, seems easy today) but also because it becomes endemic, affecting all aspects of life with synergetic effects that are impossible to predict. This is because GenAI is not a tool that can be fully controlled or predicted; it is a force that can no longer be neglected, a force or an energy whose nature and limits are difficult to grasp.

We can try to understand what is possible (e.g. tutoring of individual learners through human-like vocal interventions, designing learning environments using evidence-informed instructional design models, planning school activities and automatically inform parents, ...), we can also try to describe what we think is desirable (e.g. the teacher as an important educational agent, the use of GenAI tools to support a writing process driven by the student) but we can hardly predict what will actually happen. Will we all become addicted, will we all remain critical, will we be able to know as much as GenAI in order to be critical, will young people remain self-confident in their ability to learn, ... We do not know.

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