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# Relevant Transformative Teacher Education for Future Generations

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In this article, we investigate the need for a relevant transformative teacher education when current and future societal challenges have been decisive in defining a Norwegian education reform where interdisciplinarity in specific topics is judged crucial to current and future generations in the new National Curriculum. At the same time, Norwegian teacher education is criticized for not teaching relevant content and, hence, contributing to schools' challenges to teach for future needs. This study is part of a larger research project engaging with the UN Sustainable Development Goals and OECD's call for 21st Century Skills. The data material analyzed for this article is two-fold: (1) Regulatory documents for schools and teacher education account for the mandate given both educational levels, particularly examining similarities and differences in addressing interdisciplinary themes, methods, and assessments; (2) Questionnaire responses from 906 teachers, 155 student teachers, and 121 teacher educators respond to how they work with interdisciplinary education. The mandate assigned to the different levels of the education sector initially displays high ambitions for relevant education for a rapidly changing future. However, entering into the details, curricula seem contradictory at different educational levels, conservative, and with limited intentions of moving toward new and needed skills. Teachers are in general positive to interdisciplinary work, understand the significance to both society and individual, yet traditional activities of teaching prevail. Student teachers also judge interdisciplinary work as important but report little exposure during their teacher education. Teacher educators conduct interdisciplinary work mainly on their own but report a willingness to learn from colleagues. This study illustrates interest in, yet challenges with, interdisciplinary work across educational levels, and indicates a need for relevant transformative teacher education to be at the forefront, making educational content and methods responsive to the challenges future generations of teachers need.

**Keywords: transformative education, teacher education for sustainability, interdisciplinarity in education, curriculum for transformation, professional development**

## INTRODUCTION

In this article, we investigate the need for transformative teacher education to meet current and future societal challenges. Increasing globalization, the recent COVID-19 pandemic, and climate change are all examples of events our youth need to be able to tackle and address (Voogt and Roblin, 2012; OECD, 2019; Biseth et al., 2021). Through acknowledging the complexity of future challenges, we critically question the traditional teacher education in Norway and its' ability to adequately equip student teachers with relevant competencies. This Norwegian study can serve as an illustrative case to discuss the relevance of teacher education beyond this country context.

Norway introduced a new National Curriculum in 2020 (in short: LK20) where interdisciplinarity understood as knowledge on how to use methods of problem-solving across disciplines, is essential (The Directorate of Education and Training [UDIR], 2020). Three interdisciplinary topics, *Public Health and Life Skills, Democracy and Citizenship,* and *Sustainable Development* are described in the Core curriculum as crucial to current and future generations and pivotal for education to engage with (The Directorate of Education and Training [UDIR], 2017). This study is part of a larger research project, BRIDGES, engaged with transforming teacher education through interdisciplinary interventions within teacher education and between teacher education and schools. The project stems from the challenges addressed through the UN Sustainable Development Goals (United Nations, 2015). Through systematic work with quality education and partnerships (SDGs 4, 17), the project intends to contribute to teaching about and for sustainable development (SDGs 6, 7, 11, 12, 13, 14, 15), public health, and life skills (SDGs 1, 2, 3, 8) and democracy and citizenship (SDGs 5, 10, 16). The XX research project has the overall hypothesis: Systematized, collaborative, and critical interdisciplinary work in teacher education, through the three interdisciplinary topics described above, will improve new teachers' ability to address contemporary societal challenges, become agents of change, and empower pupils to become part of solutions needed to create sustainable and democratic societies. Although the project embraces the SDGs, what is of particular relevance to our focus in this article and the three interdisciplinary topics in the new National Curriculum, is Target 4.7:

> By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development (United Nations, 2015).

'Transformative education' in this study is understood in a broad educational context as forming an ideological nexus between liberal education, progressive education, environmental education, and education for sustainable development (Mezirow, 1996; Pavlova, 2013). Such education aims to foster transformative learning for both the teacher and the learner (Freire, 2000; Taylor, 2017). Through transformative education, teacher education needs to face the same realities of uncertain futures as our young citizens do and to educate student teachers who jointly can become agents willing and able to make an impact (McWhinney and Markos, 2003; Kitchenham, 2008).

Transforming practice requires transforming existing structures in the intersubjective and social spaces to support practice (Kemmis et al., 2014). Transformative education, practice, and interdisciplinarity are intertwined with an expected and needed collaboration across subjects and between teachers. The differences between subjects become more blurred, and the content, skill, or competence that unites the subject is at the focus of attention (Drake and Reid, 2020). Interdisciplinarity requires didactics that create space for new forms of knowledge and connections and transcend existing boundaries between different subjects (Sinnes and Straume, 2017). The interdisciplinary topics in the National Curriculum can be a door-opener to composing new ways of understanding the world (Kemmis et al., 2014).

## A ROLE FOR INTERDISCIPLINARITY IN TRANSFORMATIVE TEACHER EDUCATION

A distinction between mono-, cross-, multi-, inter-, and transdisciplinarity illustrates ways of bridging various schools of thought. These concepts are complex and used interchangeably across research literature without contrasting or specifying how these differences materialize. In this article, disciplines are regarded as traditional knowledge-specific divisions, still recognizing its potential for progressively developing content and methods and hence difficult to frame. Monodisciplinarity is single-subject specific, while crossdisciplinarity borrows concepts and methods from other schools of thought in problem-solving (Nenseth et al., 2010). Multidisciplinarity can be defined as crossing over (Stock and Burton, 2011), involving experts from different areas cooperating on solving specific problems related to their field of expertise. This may not require developing knowledge or methods from other disciplines but may result in closer awareness of these as people from different fields are cooperating side by side (Rowland, 2006). A characteristic of interdisciplinarity is fostering and adapting suitable tools from different disciplines when exploring or resolving common obstacles (Koritzinsky, 2021). Thus, multidisciplinarity differs from interdisciplinarity in whether problem-solving is resolved side by side or as a coherent whole that entails knowledge integration (Rowland, 2006; Nenseth et al., 2010; Beland Lindahl and Westholm, 2014). Transdisciplinarity entails the exchange of competencies and knowledge from outside the academic institutions through involvement and inclusion of relevant societal actors, or as problem-based learning (Nenseth et al., 2010; Beland Lindahl and Westholm, 2014; Johannesen and Øgrim, 2020). Interdisciplinarity might easily be used as a concept covering bridging of disciplines in any form, but Balsiger et al. (2004) suggests the collective term "supradisciplinarity" in all cases where a single discipline has been trespassed.

Balsiger et al. (2004) defines supradisciplinarity as an umbrella concept for all variations of discipline-crossing, covering all the above-mentioned exempt from monodisciplinary. Since this concept is somewhat unfamiliar in the Norwegian context, we use "interdisciplinary" as a collective term because of its more established meaning, though perhaps more unprecise. This is also because interdisciplinarity is a literal translation of the Norwegian concept "tverrfaglighet" essential in the Core curriculum, much of the research literature, and official documents do not offer clear distinctions and differentiation of the various approaches.

Interdisciplinarity as a field in higher education is multifaceted and partially fragmented, something that is reflected in research on the topic (Klein, 2013; Graff, 2015). Most literature on interdisciplinarity addresses higher education in general, and not teacher education specifically. In 1972 the OECD (1972) published a pivotal work on interdisciplinarity in teaching and research. A key finding was the close link between interdisciplinarity and the established cultural and intellectual traditions of different academic systems. When the OECD returned to the field some 15 years later, they found that interdisciplinarity had lost its momentum (Chettiparamb, 2007). Research on interdisciplinarity in teacher education primarily stems from education in the English-speaking world and much of the literature revolves around how the concept can be defined, and the specific relationship between disciplinarity and interdisciplinarity (Chettiparamb, 2007; Graff, 2015; Arneback and Blåsjö, 2017; Donina et al., 2017). The organization and structuring of different disciplines for student teachers to learn and develop practical pedagogical or didactic skills have received less attention, the same goes for the connection between school subjects, university education, and schoolteachers (Arneback and Blåsjö, 2017).

In our opinion, which concepts we use, be it cross-, multi-, or interdisciplinary, do not carry significance without the extent to which it signals the role it plays at any education level in contributing to addressing societal issues outside of school as illustrated in the figure below.

**Figure 1** attempts to illustrate differences in the various forms of disciplinary work, including variations in the degrees of integrating academic content, methods, and collaboration in education. Sometimes monodisciplinarity can play a positive role, for example when a young pupil is learning how to read and write in a new language. When topics in school are moving beyond a mere qualification function and toward providing pupils with an agency, subjectivication (Biesta, 2020), a high degree of integration of academic content, method, and collaboration seem needed, a way of understanding school as one means to address current and future societal needs.

Our illustration might indicate that there is a development that begins with monodisciplinarity, continues with multidisciplinarity, further developed into interdisciplinarity before reaching the transdisciplinary methods in education. We align with Balsiger et al. (2004) who specifies that whatever disciplinary chosen approach should depend on the complexity of the problem or field of interest. The critical issue is that the monodisciplinary approach is dominant in education, excluding experience and capability in other techniques essential for a transformative education.

Norwegian teacher education is criticized for not teaching relevant content and methods, and hence, contributing to schools' challenges to teach for future needs (e.g., Ministry of Education and Research, 2015, 2017). Schools may have more experience than teacher education in interdisciplinary teaching and could be regarded as a learning space for teacher educators. However, a well-documented lack of collaboration across educational levels illustrates the difficulties of such knowledge exchange (Klette and Hammerness, 2016). Such knowledge exchange is further hampered by school-university collaboration often characterized by universities supplying research results, top-down expert knowledge, or obtaining data from schools meant for the research audiences, not contributing to what teachers or future teachers need in their everyday working lives (Lillejord and Børte, 2014). This article presents data and analysis where the teachers transpire to be the experts, thus in a position of modeling interdisciplinary and collaborative methods of teaching. This analysis stems from (1) Results from analyzing the new Core curriculum, how interdisciplinarity in general, and particularly how the three interdisciplinary topics demand new ways of conceptualizing methods and learning across subjects and disciplines. This is then compared to the regulatory documents for teacher education, investigating similarities and differences; (2) Teachers' questionnaire responses on interdisciplinary work are used to contrast with that of stakeholders in teacher education: student teachers and teacher educators.

Education is meant to prepare pupils for a future we do not know, for occupations we cannot foresee, and for currently unknown challenges and technologies (Fadel, 2008; OECD, 2019). The rapid development of information and technology questions and confronts the education system as currently insufficient in equipping young people for the future (Karakoyun and Lindberg, 2020). To counter these obstacles, several countries have included what is entitled 21st Century skills and competences in different variations (Fadel, 2008; Voogt and Roblin, 2012; Acedo and Hughes, 2014; OECD, 2019). In addition, transversal skills have become more prominent, i.e., skills not related to one academic discipline, one particular job or task you need to do, but skills based on a wide array of knowledge and possible to use in a wide variety of situations and work settings (UNESCO, 2013; Larraz et al., 2017). The rapid evolvement of the labor market, society, and, hence, the new skills needed, influence Norwegian education at both policy (Ludvigsen et al., 2014) and curricular level (The Directorate of Education and Training [UDIR], 2017, 2020). With the school sector engaged in meeting current and future societal challenges through education reform where interdisciplinarity is essential and equipping youth with competences needed for a potentially unknown future, we argue the need for teacher education of a transformative character.

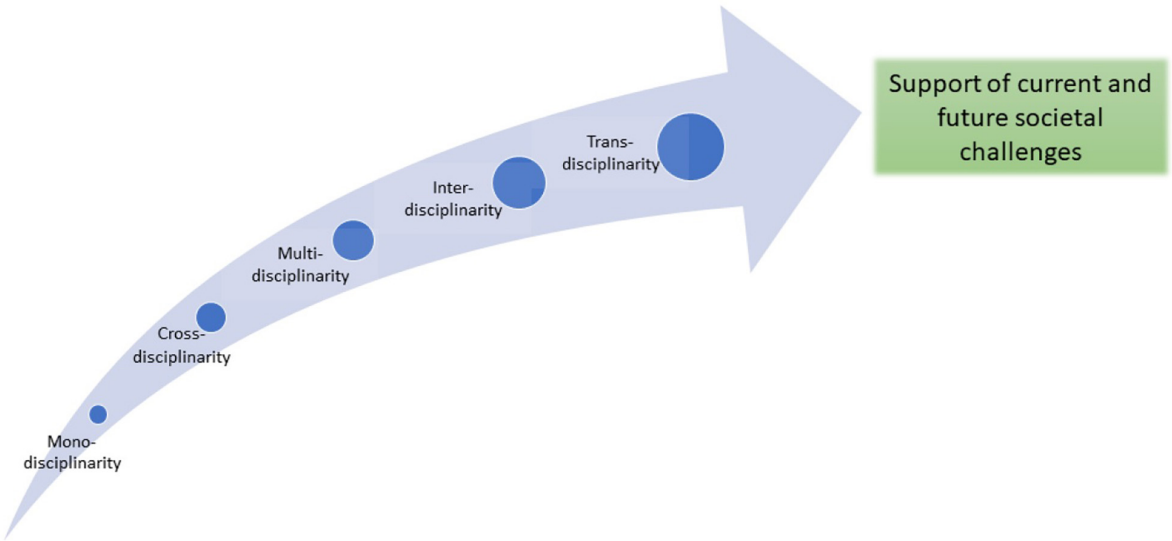


**FIGURE 1 |** Illustration of the variation of interdisciplinary teaching and learning methods and their contribution to societal needs. Source: The authors.

## MATERIALS AND METHODS

A comparative case study research design (Bartlet and Vavrus, 2017) is applied in which we trace our phenomenon of interest (Ragin, 2014): the significance of interdisciplinary teaching and learning to develop a teacher education suited for the needs of the 21st century, and the role of or even need for transformative education in it. A comparative case study design enables us to simultaneously attend to macro, meso, and micro dimensions in our study (Bartlet and Vavrus, 2017). We move from the phenomenon in policy documents and investigate how it is manifested among various actors at different levels in education.

Two groups of material are collected and compared in this study:

1) Regulatory documents for schools and teacher education account for the mandate given both educational levels.

The regulatory documents are chosen because they are legally binding for the education sector, hence, expecting practical implications. The Core curriculum of the new *National Curriculum for Knowledge Promotion 2020* (LK20), was completed in 2017 (The Directorate of Education and Training [UDIR], 2017) and describes the values and principles required to permeate Norwegian primary and secondary education. This document was in place when teachers in this study responded to a questionnaire. The new subject curricula, however, were not, and are therefore not included. Regulations Relating to the Framework Plan for Primary and Lower Secondary Teacher Education for Years 1–7 (Ministry of Education and Research, 2016a), Years 5–10 (Ministry of Education and Research, 2016b), and The National guidelines for Primary and Lower Secondary Teacher Education (Nasjonalt råd for lærerutdanning, 2016) are included as documents for analysis of teacher education.

2) Questionnaire responses from teachers, student teachers, and teacher educators on how they work with interdisciplinary education:

- *906 teachers* from four regions in Norway responded in 2019 to questions on how they understand and work with the three interdisciplinary topics in the new National Curriculum, and the main obstacles and benefits in working interdisciplinary in their schools and classrooms in
- *155 student teachers* from three Norwegian teacher education institutions responded in 2021 to questions on how they understand interdisciplinarity in education, to what extent they are exposed to interdisciplinary working methods in their teacher education programs, and how they experience the three interdisciplinary topics to be a part of their teacher education program.
- *121 teacher educators* from three Norwegian teacher education institutions responding in 2021 to questions on the main obstacles and benefits in working interdisciplinary, and how and to what extent the three interdisciplinary topics are integrated into their work.

The teachers responding to the questionnaire have been part of a country-wide local professional development program in 2019 preparing for the three interdisciplinary topics in the new National Curriculum. Some of the researchers in the BRIDGES project have been involved in this professional development program, yet anonymity is assured. The response rate is above 90%. The student teachers and teacher educators are recruited from the three teacher education institutions participating in the project. They responded to questionnaires in February 2021. The response rate among student teachers and teacher educations was 10% and 23%, respectively. At this point, Norway was still

in lock-down due to Covid-19 restrictions, higher education institutions were closed with teacher educators confined to home offices and student teachers attending online classes and online supervision only. Not including the questionnaire for student teachers during physical classes on campus has been one factor influencing the response rate.

Challenges with external validity are present in the study as we were prevented from a random sampling strategy and a low response rate among two of the groups. In those two groups, it is possible to imagine that those who are more dedicated to or interested in the three interdisciplinary topics in the new curriculum were more likely to respond to the questionnaire than those who are less interested and thus skewing the results. We could not see from the material, however, an unexpected trend. Regardless of the low response rate among student teachers and teacher educators, the material provides useful insight into educators' perspectives, experiences, and self-reported work with interdisciplinarity. The low response rate from student teachers and teacher educators does not necessarily indicate a poor-quality questionnaire. A more important response quality indicator is if the characteristics of those who responded are significantly different from the characteristics of those who did not respond. As educators in this study represent a wide diversity of teaching subjects such as science, mathematics, sports, languages, social studies, religion, esthetic subjects, and music, it is not likely that these significant factors have resulted in a non-response error (Dillman et al., 2014).

We acknowledge that the contexts, social networks, national policies, and power relations influence the perspectives and responses of the individual participants. The study has given us a snapshot of educators' perspectives at a certain point in time when the new Norwegian National Curriculum was recently introduced and with all the educators in a policy-to-implementation process. As such, we judge this contributing as part of an ongoing dialog between concept formation and data analysis, supporting our quest to develop and refine our ideas, concepts, hypothesis, and theory formulations (Ragin, 2014).

The project has obtained approval from the Norwegian Centre for Research Data (NSD) and complies with ethical guidelines from The National Committee for Research Ethics in the Social Sciences and the Humanities (The National Committee for Research Ethics in the Social Sciences and the Humanities [NESH], 2016).

# RESULTS

## The Interdisciplinary Mandate Assigned to Education

Due to its legal status, the National Curriculum is central in describing the mandate assigned to Norwegian education. The curriculum consists of a Core curriculum outlining values and principles for primary and secondary education (The Directorate of Education and Training [UDIR], 2017), in addition to subject curricula (The Directorate of Education and Training [UDIR], 2020). Its normative aims guide development, teaching, academic content, and methods in schools where critical thinking and various exploratory approaches using senses, reason, and collaboration are specified (The Directorate of Education and Training [UDIR], 2017). The interdisciplinary mandate appears through an appeal to consolidate the goal for competencies which requires an understanding of possible connections between separate academic disciplines (Frøjd, 2020).

> The competence goals in the subjects must be considered together, both in and across the subjects. The competence goals must also be understood in light of the objectives clause [of the Education Act] and the other sections of the curriculum (The Directorate of Education and Training [UDIR], 2017).

Societal challenges have raised the need for interdisciplinarity in education, now made explicitly through implementing three interdisciplinary topics, and implicitly suggesting bridging the gap between academic disciplines to support competences to stimulate creative and critical problem-solving.

> The knowledge base for finding solutions to problems can be found in many subjects, and the topics must help the pupils to achieve understanding and to see connections across subjects. The goals for what the pupils should learn in the topics are stated in the competence goals for the individual subjects where this is relevant (The Directorate of Education and Training [UDIR], 2017).

Each of the current subject curricula has general descriptions at the start including a description of each subject's relevance and value, core elements, how the three interdisciplinary topics are to be included in the subject, and how basic and transversal skills are to be addressed. In previous National curricula, academic content was set, but with extensive local freedom to choose teaching methods and learning activities. In LK20 interdisciplinarity is prominent. Further, the Core curriculum stresses the usefulness of cooperation at the pupil, teacher, and management level to develop and share knowledge, competencies, and experiences (The Directorate of Education and Training [UDIR], 2017).

The Regulations Relating to the Framework Plans for Teacher Education for primary and lower secondary, § 2, state that graduates should be able to analyze, adapt and use relevant curricula, and have a thorough knowledge of relevant laws and regulations (Ministry of Education and Research, 2016a,b). This implies that teacher education must be able to adjust to meet the demands and goals as described in curricula and laws that are relevant for and regulate schools. The intentions and results of the revision of the National Curriculum should manifest in teacher education, both within disciplines and through interactions with pupils and schools. The framework plan itself contains elements that are directly linked to the three interdisciplinary topics in the curriculum. Through teacher education, the graduate should be able to

> reinforce international and multicultural perspectives in the work of the school [. . .] and encourage democratic participation and sustainable development (Ministry of Education and Research, 2016a,b).

*Public Health and Life Skills* are present in several forms, though not as directly stated as the two other topics. For instance, the graduate should

> have knowledge of children living in difficult circumstances, including knowledge of violence and sexual abuse against children,
>
> and should be able to
>
> create inclusive and health-promoting learning environments[. . .] (Ministry of Education and Research, 2016a,b).

However, the Framework Plans only state the overall scopes and objectives that should be included in the teacher education programs and do not stipulate direct practical implementations. There are no references to interdisciplinary didactics or methods in the Framework Plans. Didactics, methods, and instructions are integral parts of the different subjects. It is possible to claim though, that this provides teacher education programs and individual teacher educators with a pedagogical space to ensure the implementation of interdisciplinarity in teacher education.

National Guidelines for Quality in Teacher Education (Nasjonalt råd for lærerutdanning, 2016) are to some extent more specific in their description of expected learning outcomes for graduates, which can be related to the three interdisciplinary topics for graduates. Nevertheless, the way the three topics are presented here aligns to a lesser extent with the descriptions we find in the Core curriculum. An explanation can be that the guidelines were developed before the renewal of the curriculum was completed, and therefore refers to the reports on which the white papers were based, even though the Core curriculum was published already in 2017. Another explanation can be that these three topics have been an integral part of teacher education before and independently of prioritizations in the National Curriculum. Additionally, the guidelines emphasize knowledge and comprehension of the three topics, without relating these to pedagogics or didactics. Sustainable development is an exception, though, where *education for sustainable development* is explicitly mentioned, implying a defined methodology (UNECE, 2016).

## Interdisciplinary Perspectives and Work Among Teachers

More than 80% of the teachers in this study understand interdisciplinary teaching as a way of making teaching more relevant for school children and connecting the teaching to challenges in society or the local community. They also regard interdisciplinary teaching as a way for their pupils to learn more and gain increased learning outcomes. The teachers place predominant emphasis on the pupils' perspective in their reasons for working interdisciplinary, that it can be time-saving or otherwise practical. They only to a limited degree use the National Curriculum as an argument for their choices. A high percentage of teachers (67%) consider interdisciplinary work significant in their own professional development. They emphasize the importance of interdisciplinary teaching and learning activities to make school relevant and better for their pupils, and for making themselves improve as professionals. Yet, it is interesting that there is a discrepancy between what teachers consider important and what they report on doing, as only 40% of the teachers in our material report interdisciplinary work to a considerable extent.

59% of the teachers claim to work interdisciplinary by developing joint projects, either together as a school, or in teams of teachers working at the same grade level. Despite these engagements in interdisciplinary work, teachers reported such teaching activities to occur only occasionally. Our results, nevertheless, confirm that teaching one subject at a time is still the dominant model of structuring education. So, both moving beyond the intention-praxis barrier seem difficult, as well as making use of their knowledge about what works and what is needed to transform education is a challenge, as we have also seen in other studies (e.g., Generett and Hicks, 2004; Hicks et al., 2005).

## Interdisciplinary Perspectives and Work in Teacher Education

Two groups of stakeholders in teacher education are included in this study: Student teachers and teacher educators. 33% of the student teachers in this study understand school subjects only as means to an end, meaning that what is important are the learning outcomes relevant for the individual and society, not each school subject for its own purpose. Teachers collaborating across school subjects in, for example, a project-based approach in which a specific topic is on the agenda, are important to 28% of the student teachers, while 31% of the student teachers value the need to connect several school subjects as significant for their work in school.

The results indicate that most student teachers seem to have some understanding of interdisciplinary approaches in school, although some are more comprehensive in their perspectives than others. Compared to their understanding of the relevance of interdisciplinary work in school, student teachers report having limited experience with interdisciplinary working methods in the teacher education program. Only 10% of the student teachers experience the use of interdisciplinary teaching methods to a large extent during their studies, and almost 50% of the student teachers report teacher educators to use interdisciplinary working methods to a small extent.

Overall, the student teachers report a limited degree of interdisciplinarity in the teaching and learning activities they receive in teacher education. However, when asked if they have experience of working with the three interdisciplinary topics in teacher education, a somewhat larger proportion of student teachers claim that the topics have been addressed in teacher education. 63% of the student teachers report the three interdisciplinary topics in the National Curriculum, i.e., *Public Health and Life Skills*, *Democracy and Citizenship*, and *Sustainable Development* have been addressed to a large or to some extent.

*Public health and Life Skills*, *Democracy and Citizenship*, and *Sustainable Development* can be the subject of teaching in several subjects, by different teachers, without the teachers necessarily collaborating on the planning or teaching. We find little or no differences between the three interdisciplinary topics as the student teachers report that the three interdisciplinary topics

are emphasized and treated to the same degree in their teacher education programs.

The student teachers in this study have a varied understanding of interdisciplinarity, yet they do not experience a teacher education providing them with didactical tools or models for interdisciplinary work in schools. The student teachers' reporting on the amount or frequency of interdisciplinary work differs from how the teacher educators report on interdisciplinarity.

More than 80% of the teacher educators report that they include cross-disciplinary perspectives in their own subjects (see **Figure 2**). Hence, the most common form of interdisciplinarity is planned and implemented within the framework of the subject they teach themselves. 37% of the teacher educators make thematic teaching plans across subjects, while 55% of the teachers coordinate work on diverse topics with other teachers in the teacher education program. This last strategy might be described more as a multidisciplinary than an interdisciplinary teaching strategy.

The interdisciplinarity in teacher education is present in various parts of education (see **Figure 3**). While interdisciplinarity is present in a large majority of the teaching sessions at the universities, the teacher educators report that interdisciplinarity is less attended to in student teachers' practice placements. Further, the teachers report that interdisciplinarity is themed in their subject plans but is to a lesser extent a theme in the study plan encompassing the entire teacher education program. Interdisciplinarity appears mainly to be linked to the teacher educators' own plans and implemented in their teaching.

In the preparations for practice placement, the practice placement follow-up, and the assignments the student teachers complete after the practice placement, a large majority of the teacher educators report that interdisciplinarity is only visible to some degree or a small degree.

A large majority of the teacher educators (88%) find interdisciplinary collaboration in teacher education demanding. They report a significant lack of arenas to discuss

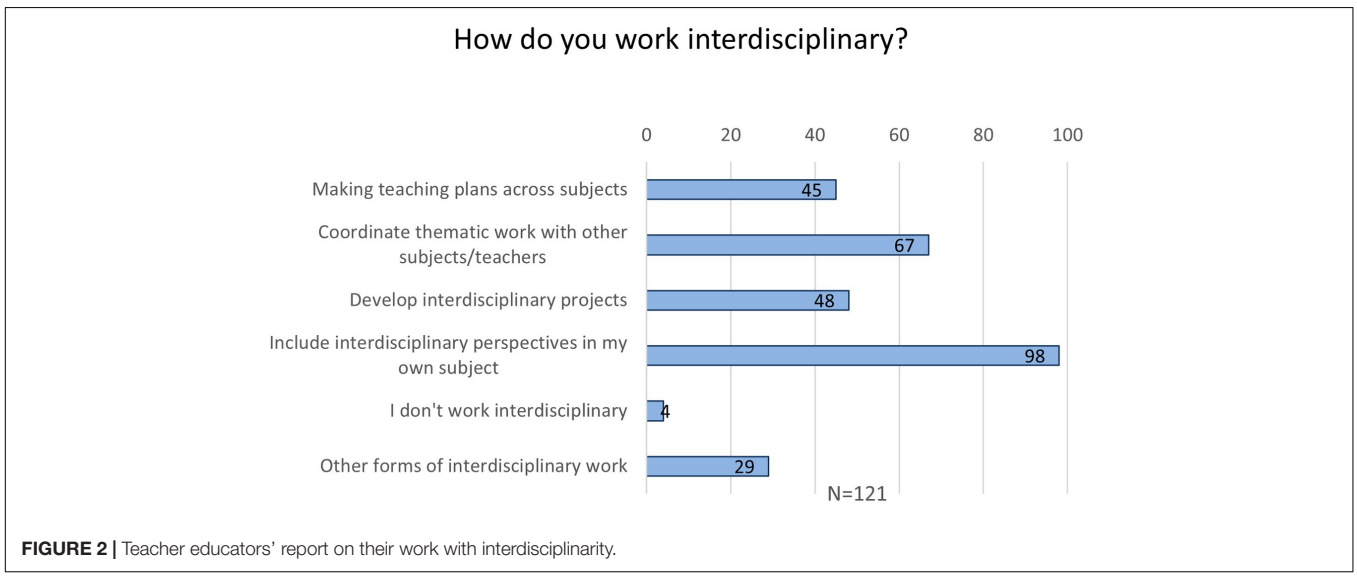


**FIGURE 2 |** Teacher educators' report on their work with interdisciplinarity.

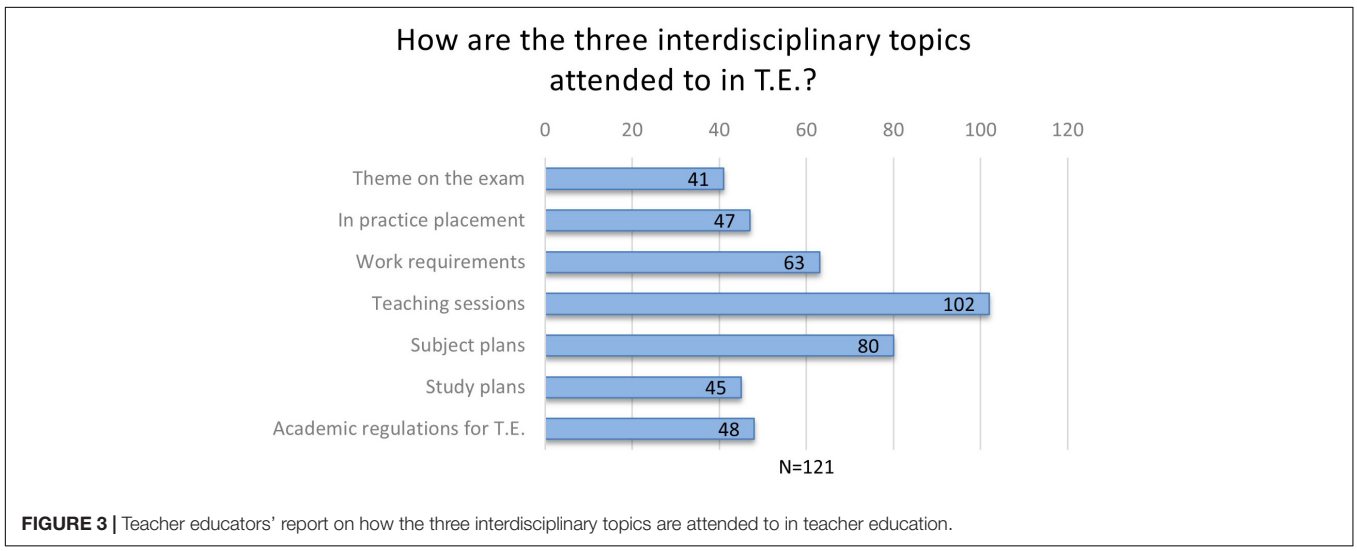


**FIGURE 3 |** Teacher educators' report on how the three interdisciplinary topics are attended to in teacher education.

interdisciplinary topics and modes of teaching, and they report on several conditions needed if they are to succeed in interdisciplinary work (see **Figure 4**). The teacher educators call for more interest and knowledge of interdisciplinary work in teacher education from the management level as the most important condition for succeeding with this kind of work. In addition, 48% find it significant that lessons are pre-decided as interdisciplinary through study- and subject plans. Both of these answers do to some extent push the responsibility of interdisciplinarity onto someone else than the individual teacher educator.

From our study, we have indications that the management level believes to have supported and facilitated interdisciplinary work, yet this is not how it is perceived by the teacher educators. Another necessary condition is a closer collaboration with colleagues. 28% of the teacher educators claim that they want to learn from colleagues to develop something new in their teaching, the result indicates a willingness to work interdisciplinary—given conditions that facilitate such work, like a stronger grounding in curricula and management.

The interdisciplinary mandate appears more prominent in the Core curriculum than in the Framework Plans for Teacher Education. The curriculums' appeal to combine the goal for competencies requires an understanding of possible connections between separate academic subjects, and the plan explicitly includes the three interdisciplinary topics, while the Framework Plans for Teacher Education does not include references to interdisciplinary topics, didactics, or methods. Teachers are in general positive to interdisciplinary educational work, they understand the significance of this to society and individuals, yet traditional activities of teaching prevail. Student teachers also understand interdisciplinary educational work as important but report little exposure to it during their teacher education. Teacher educators conduct interdisciplinary educational work mainly within their subjects but report a willingness to learn from colleagues. At all levels of education this study illustrates interest in, yet challenges with, interdisciplinary educational work.

## DISCUSSION

The Core curriculum for primary and secondary education presents itself to some extent as a bit contradictory in the sense that the values and principles for education outline a system addressing issues of global and local citizenship, promoting sustainable development with climate topics, equality, pushing human rights, non-violence, and peace. To achieve this, interdisciplinary approaches to varying degrees are considered crucial, yet not explicitly specified in the document. Despite the public input from all levels of the education sector, policymakers decided against a more detailed document. However, space is still open for interacting across subjects, levels, teachers, and other stakeholders.

The mandate assigned to teacher education is not in sync with the new National Curriculum as it was in place some years in advance. The Ministry of Education and Research did not mention any need for interdisciplinary work in the Framework Plans for Teacher Education. The National Council of Teacher Education provided the Guidelines for quality in teacher education and mentioned interdisciplinary themes, and elements of the three interdisciplinary topics, yet not as explicit as displayed in the Core curriculum. While LK20 demands interdisciplinary efforts, collaboration across subjects and educational levels, the Framework Plan for Teacher Education addresses interdisciplinarity only to a limited degree, as objectives or methods related to interdisciplinarity are not explicitly formulated in the curriculum for teacher education. At the same time, teacher education is obliged to connect to content and methods described in the LK20. On the one hand, this makes it possible to omit the three topics from teacher education, but not interdisciplinary work with transversal skills. On the other hand, it is possible to argue that the obligation for teacher education to comply with the current National Curriculum, and the lack of specificity on approach could be interpreted as possibilities to develop a relevant transformative teacher education addressing supporting new generations of teachers to face the school realities

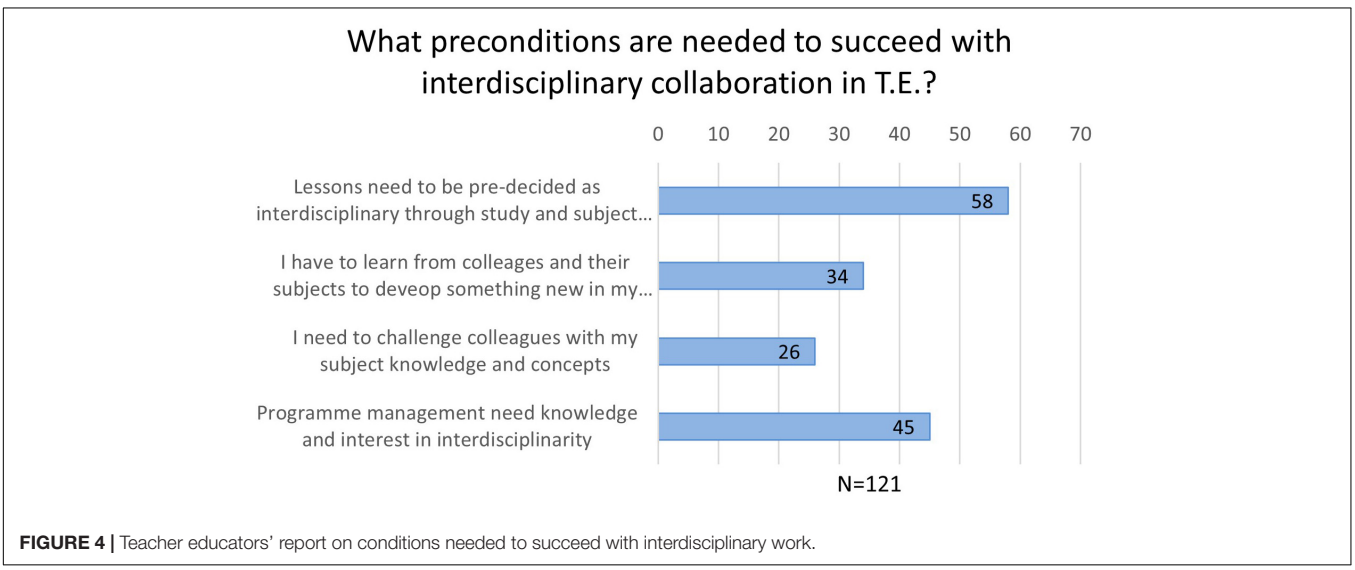


**FIGURE 4 |** Teacher educators' report on conditions needed to succeed with interdisciplinary work.

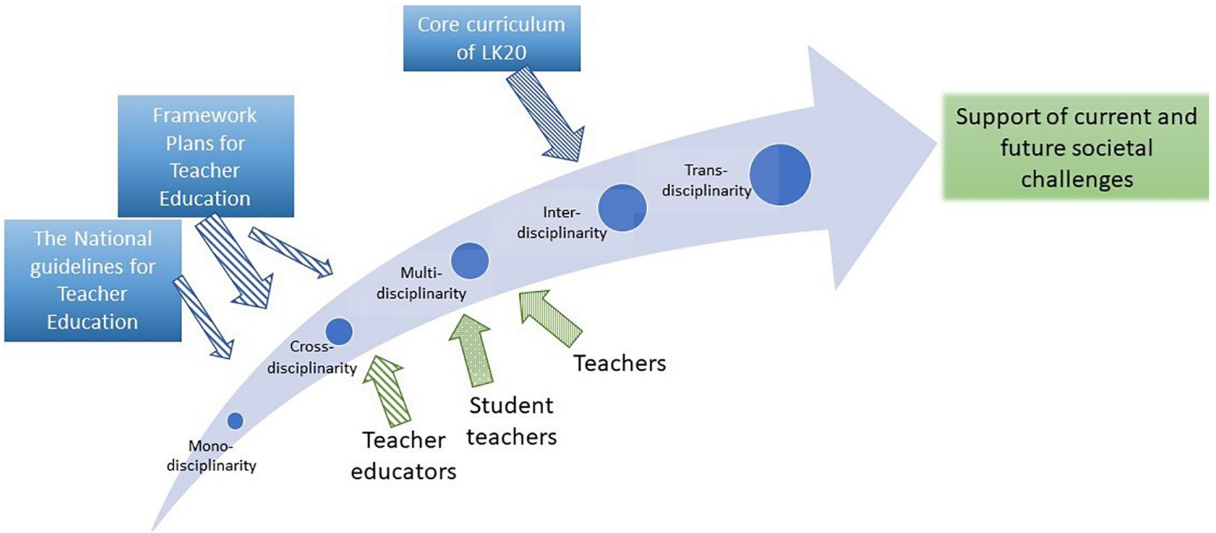


**FIGURE 5 |** Positioning the mandate assigned and the stakeholders involved.

when graduating and addressing current and future societal needs and challenges.

The initial analysis of teachers, student teachers, and teacher educators' perspectives and self-reported practices with interdisciplinary work reveals a need for comprehensive changes in teacher education to educate future teachers who can address the societal needs as both described by the Norwegian Government through the new National Curriculum and the international commitment through the UN Sustainable Development Goals (United Nations, 2015) and OECD's call for 21st Century Skills (OECD, 2019). Our analyses indicate that teachers, to a larger extent than teacher educators, implement and explore interdisciplinary methods of teaching. Schools and teachers convey a potential for transferring experience with interdisciplinary teaching. As teacher education is relatively limited in this regard, the potential displayed by other stakeholders does not seem to be a result of the work in teacher education. In other words, teachers have learned their skills outside teacher education. This points to a teacher education partially irrelevant and at odds with the needs in school and society. These results illustrate the necessity for teacher education to grasp the opportunity to implement interdisciplinarity aligned with legal regulations and consider the role of transformative practices as a tool to achieve needed results (Mezirow, 1996; Freire, 2000; Hicks et al., 2005).

The content knowledge in teacher education encompasses academic theoretical content, didactics, and teaching methods. As student teachers call for less abstract teaching, more practical pedagogy, report a lack of modeling of methods, problem-based learning, and student-active working methods, this points toward a need for a teacher education that is relevant and transformative (McWhinney and Markos, 2003; Kitchenham, 2008). In our study, it turns out that it is in methodological knowledge about interdisciplinary teaching methods where the gap between teacher education and school is most clearly experienced. The student teachers report a lack of interdisciplinary collaboration between different subjects. The interdisciplinary topics, *Public Health and Life Skills*, *Democracy and Citizenship*, and *Sustainable Development,* can be linked to the content dimensions across a variation in a coherent manner. In that way, the large group of student teachers claiming the topics to have been addressed in the teacher education program, may also experience them in greater depth and nuance, and integrated, supporting student teachers in their critical thinking—and action (Generett and Hicks, 2004).

School and teacher education are characterized by different traditions, both when it comes to the division of knowledge into disciplines and when it comes to teaching methods. The universities' long tradition of organizing knowledge into specific disciplines, and passing on the inherited knowledge of society, also characterizes traditional schools. Most subjects are taught separately. But schools also have another tradition, which stems from the ideas of reform pedagogy in the middle of the last century, which has had a considerable influence on teaching and learning practices. The 1980s and'90s were progressive, reform-friendly periods, when project work, interdisciplinary and problem-based learning was emphasized. Many teachers have experience in this area, either as teachers or students. The universities do not have the same historical heritage of progressive education (e.g., Sjøberg, 2001; Dale and Waerness, 2006; Koritzinsky, 2021).

Teacher educators and teachers can perceive interdisciplinarity differently. In a university context, a subject can be seen as interdisciplinary *per se*. When teacher educators claim to work interdisciplinary within their own subject, they may consider doing so in line with how their academic discipline is organized in the school subject taught in teacher education. One example can be an evolutionary biologist teaching general biology in teacher education, including themes beyond her specialization. As biology is a sub-theme of science, she could be as bold to collaborate with colleagues teaching chemistry

and physics. Or a historian specialized in law and justice in the Viking area, teaching in the subject of social studies in teacher education and bringing in geopolitics, sociology, and life skills. Both the teacher educator of science and social studies in this example may experience a sense of interdisciplinary work despite working on their own in a teaching situation. Further, collaboration is regarded as demanding, and the teacher educators report a lack of arenas to cooperate and a need for facilitation from the management level. For schoolteachers, interdisciplinarity seems to emphasize the perception of teaming up, involving two or more teachers, teaching different subjects. Hence, school and teacher education are characterized by rather different academic traditions. This collision between different academic traditions does not seem to be picked up by the student teachers, as they claim that interdisciplinarity is almost absent in teacher education. Interdisciplinarity within a subject, as teacher educators practice, can be a possible entrance to interdisciplinary work, but it is not in line with school reality. This means that the student teachers are neither provided with tools nor sufficient content to address the three interdisciplinary topics in an interdisciplinary way.

Both structural and cultural obstacles must be challenged for the various subject teachers to work interdisciplinary. The student teachers have expectations of interdisciplinarity in teacher education, and the schoolteachers self-reporting interdisciplinarity as close collaboration to a larger extent than the teacher educators in this survey. Schools may have more experience than teacher education in interdisciplinary work, and teacher educators have the development potential to realize the expectations both from the management documents and from the student teachers. However, this face challenges when there is a well-documented lack of collaboration across educational levels (Klette and Hammerness, 2016), and within teacher education. This shows a need for teacher education to move away from traditional forms of education, making educational content and methods responsive to the challenges future generations of teachers need. To ensure such a teacher education, there might be a need to transform the focus in academia on individual achievements toward a stance of collaboration (Minnis and John-Steiner, 2005, p. 58).

LK20 poses a challenge and opportunity for collaboration across subjects and educational levels. The vagueness of only implicitly proposing interdisciplinarity generates unclarity on implementation and organization. In addition, the three interdisciplinarity topics of *Public Health and Life Skills*, *Democracy and Citizenship*, and *Sustainable Development* are stated overall thematically focal across subjects. The overlapping concepts of interdisciplinarity as a way of organizing subjects, and thematic overlapping topics, require interpretation and understanding of LK20's different fragments and how to combine them. This could result in 'business as usual' due to a lack of a clarified mandate to work interdisciplinary both thematically and methodically. However, when summing up the results, we see a nuanced picture as illustrated in **Figure 5**.

The mandate assigned to the primary and secondary education sector is clearer on interdisciplinarity, both in content and method, yet we place it on a continuum from monodisciplinarity toward transdisciplinarity, somewhere in between interdisciplinarity and multidisciplinarity as moves more toward a vague side. What is more promising is that teachers are clear about the need for and benefits of interdisciplinary education. We place them close to interdisciplinarity on the continuum although they report a bit lower when it comes to their practice – despite their understanding of the significance of interdisciplinary work. The mandate assigned to the teacher education program for primary and secondary education has some traces of collaboration, crosscutting themes, and the role of teacher education in society. Yet, the main focus seems to be crossdisciplinarity. When teacher educators report on their work, they tend to respond in line with the mandate assigned teacher education, and take a crossdisciplinarity approach, with some leaning toward monodisciplinarity and others toward multidisciplinarity. These perspectives are to some extent supported by the student teachers' responses. They claim the teacher education is not in sync with the reality they need to face when starting their work lives. However, it seems that teachers and the majority of teacher educators are doing better on the monodisciplinarity-transdisciplinarity continuum than the mandate they are assigned.

The ambitions described in the regulatory documents of the education sector are setting the stage for how educators behave. A mandate providing mixed signals on the importance of transformative and interdisciplinary on the one hand, and being subject-oriented on the other, leads to an education system zigzagging in the direction of an uncertain future. While what we need, as we see particularly in the teachers' responses, is an education sector that can bring about agents of change. Relevant transformative teacher education for future generations can develop what is needed – if necessary hope, courage, and willingness to change is in place (Freire, 2000; Generett and Hicks, 2004; Hicks et al., 2005; Kemmis et al., 2014; United Nations, 2015; Biesta, 2020).

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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