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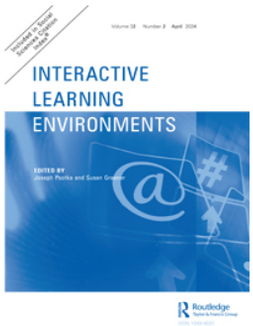

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REVIEW ARTICLE

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How teacher educators use response systems – an interview study

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ABSTRACT

Teacher educators' distinct and dual task of educating future teachers includes using digital tools to support students' ongoing learning while exemplifying appropriate teaching strategies where the use of digital tools, such as response systems (RSs), are commonly occurring. RSs have been used in higher education for a long time, and many studies discuss how larger student groups answering multiple-choice questions during lectures contribute to student participation and learning. However, there is limited research on RSs, particularly related to teacher education. Therefore, this interview study aims to explore for what purposes teacher educators use RSs in teaching and what advantages and limitations they experience. In the thematic analysis, we found that the teacher educators used RSs to teach simultaneously as they were role models on how to use digital tools for learning. They used anonymous open-text answers more than multiple-choice questions to support student participation, immediately assess, and provide feedback in both larger and smaller groups. The complexity of time management connected to the use of RSs was highlighted. RSs were also used to initiate discussions with the teacher students about the purposes, advantages, and limitations of using digital tools for learning.

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KEYWORDS
Response systems; teacher education; student participation; student engagement; formative assessment

1. Introduction

Teacher students need to learn how they can integrate digital technology into their teaching to meet the changing needs of their future students (Gunter & Reeves, 2017; Tondeur et al., 2012). However, it is not sufficient to only teach students how to use digital tools practically; they also need to understand how it can contribute to promoting learning strategies (Tondeur et al., 2012). Teachers who believe that digital technology is valuable are more likely to integrate it into their teaching (Ottenbreit-Leftwich et al., 2010). Examples provided by experienced teacher educators could be important to motivate other educators to use digital tools in their teaching (Amhag et al., 2019). Previous research dating back to the 1970s suggests that response systems (RSs) can increase student participation and improve learning. However, the rapid development of RSs might transform how they are used as new RS technologies and applications are being developed. While there is an abundance of research on RSs in higher education (e.g. Hussain & Wilby, 2019; Grzeskowiak et al., 2015), there are very few studies that study the use of RSs in teacher education. Given that using RSs might increase student participation and learning and that teacher students need to integrate digital tools in their teaching, it is important to explore how these tools are used in current teacher education contexts, which is why we, in this study, have focused on how teacher educators use RSs.

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RSs have been used in educational contexts since the 1960s (Bessler & Nisbet, 1971; Judson & Sawada, 2002). They have varied in constructions and what functions they offer, but typically, they allow students in larger lecture halls to immediately respond to an instructor's multiple-choice questions through an electronic sending unit (Judson & Sawada, 2002). The format of RSs has developed from telephone number pads at student seats and hand-held keypads with transmitters (clickers) to online RSs that offer a wider range of functions. Online RSs allow the students to contribute – often anonymously – through their smartphones, tablets, or computers during the lecture or seminar, and the teachers can receive and react to a real-time snapshot of the students and adjust the content depending on the class response (Einum, 2019; Nagy-Shadman & Desrochers, 2008). The submissions are immediately tallied and can be displayed on a screen where the students and the instructor can see and discuss them (Caldwell, 2007).

Several studies have found that RSs can be used to encourage student participation and improve classroom interaction (e.g. Chan et al., 2019; Keough, 2012; Wang, 2018). Researchers have agreed that active participation in classroom discussions and assignments is beneficial to student learning and that the transition from passive learning methods towards a more student-centered active learning leads to a significant increase in satisfaction, engagement, and learning (Auster & MacRone, 1994; Kember & Gow, 1994; Knight & Wood, 2005; Michael, 2006). Usually, these teaching contexts are characterized by environments where students participate, learn, and listen to others' ideas, comments, and questions (Wade, 1994).

1.1. Aim and research questions

There is limited research on the use of RSs in teacher education. However, there are some exceptions. For example, Hargrave et al. (2000) interviewed five teacher educators who argued that RSs supported students participating in class and helped instructors monitor student progress. Still, we lack more recent and detailed accounts from teacher educators of why and how they use RSs in their teaching to gain a better understanding of their purposes for using them and an examination of their experiences of using RSs in their teaching practices. We address this lack of research by interviewing experienced teacher educators about their experiences. Thus, this study aims to explore experienced teacher educators' experiences of using RSs in their teaching. It is guided by the following research questions:

(1) For what purposes do teacher educators describe that they use RSs?
(2) What advantages and limitations do teacher educators experience connected to RSs?

2. Theoretical background

A socio-constructivist perspective on learning posits that individuals actively construct their own understanding and knowledge through interactions with their environment, including interactions with other people (Vygotsky, 1978). According to this perspective, learning is not just an individual process but one that is shaped by interactions and discussions with others (Bruner, 1990). By using RSs, teachers can create opportunities for students to engage in these types of interactions, both with the teacher and with their classmates. This can lead to a deeper understanding and retention of the material being taught (Dillenbourg, 1999).

In educational contexts, RSs have been widely adopted and researched and are often referred to as classroom, student, audience, electronic, digital, and online response systems (Einum, 2020). An overarching goal of RS use is commonly to encourage students to take a more active role in learning activities and promote class participation (Chan et al., 2019). This aligns with a socio-constructivist perspective on learning, which emphasizes the importance of social interactions and collaboration in the learning process (Lave & Wenger, 1991; Vygotsky, 1978). Increasing student participation is a strategy that might lead to improved student learning (Hrastinski, 2009; Stowell & Nelson, 2007).

There are many different ways in which RSs can be used in teaching. The instructor's purpose of the learning activity usually guides what functions of the RS the instructor chooses to use. Although many RSs allow the instructor to pose or gather questions spontaneously during a lecture or a seminar, the questions are generally formulated in advance by the instructor (Caldwell, 2007). Using multiple-choice questions in an RS is common in educational contexts, where the purpose typically is to check whether students are paying attention, keeping up with homework, and are able to recall material from previous lectures (Caldwell, 2007). However, multiple-choice questions usually provide a limited response pattern regulated by the provided alternatives (Einum, 2020). Another common purpose of using RSs is to increase interaction by questions that start or focus discussions or collect votes (Draper et al., 2002). Apart from supporting student participation, it has also been suggested that using the text response functionality in RSs as an alternative communication channel has the potential to significantly broaden and diversify communication in the classroom (Einum, 2020). Open-ended, or divergent questions, can be used to explore students' experiences, construct ideas and interpretations, and student reflections (Biggs & Tang, 2011).

Hand-held keypads (clickers) have been used to assess student learning, provide students with immediate feedback, and facilitate active learning by provoking students' discussion (Trees & Jackson, 2007). In one study, clickers were associated with more classroom participation than other forms of audience response, for instance, paper response cards or hand-raising (Stowell & Nelson, 2007). In another, clickers were used to monitor individual students' progress, and correct answers were awarded bonus points on the exam (Engström & Norström, 2022).

RSs are also often used in the context of flipped classroom and peer instruction. In a flipped classroom, students study instructional material before class (e.g. by watching online lectures) and apply the learning material during class (Van Alten et al., 2019). Instead of using classroom time to transmit knowledge to students through lectures, the teacher is able to spend more time on more interactive learning activities such as discussions, solving problems proposed by the students, and guidance (Akçayır & Akçayır, 2018). Related to the idea of flipped classroom is the concept of peer instruction, with the purpose of engaging students during class through activities that require each student to apply the core concepts presented and then explain those concepts to another student. Unlike the common practice of asking informal questions during a lecture, which typically engages only a few highly motivated students, the more structured questioning process of peer instruction involves more students in the class (Crouch & Mazur, 2001).

RSs can also be used to enhance formative strategies. For instance, questions that probe students' pre-existing level of understanding**,** assess students' understandings or misunderstandings of material in a seminar or lecture, and by that information determine the future direction. The distinguishing characteristic of formative assessment has been defined as when the results are used to adapt the teaching to meet the students' needs (Black & Wiliam, 1998). The information about the students can also determine whether they are ready to continue after working on a problem (Poulis et al., 1998). Beatty (2004) stresses that continuous evaluation through RSs is also beneficial to students. Identifying strengths and areas of improvement helps the students take charge of their own learning and expose misconceptions.

In RS research, anonymity is often mentioned as an enabler of student participation (Caldwell, 2007; Hunsu et al., 2016). In a study from 2007, the most apparent benefit of using clickers instead of hand-raising or response cards was the increased honesty of student feedback (Stowell & Nelson, 2007). It was found that students tend to answer more honestly to posed questions if they are given the opportunity to be anonymous. The same study also highlights that anonymity creates an avenue for interaction with students who might be too shy to speak or even raise their hands (Stowell & Nelson, 2007).

Although an RS can be a flexible tool in teaching, one of the challenges with using RSs is creating and using high-quality or high-level questions. As well as taking time to formulate, they demand a certain amount of wait time when being answered by the students (Biggs & Tang, 2011). It has been suggested that in order to direct the students' responses toward reasoning rather than answers, RS

questions should avoid calculations, memorization, or facts and instead address a specific learning objective, content goal, skill, or reinforce a particular belief about learning (Beatty, 2004; Beatty et al., 2006). For instance, questions can provide information about students' knowledge or beliefs, make the students aware of others' views, and locate misconceptions and confusion (Beatty, 2004). The questions included in the learning activity need to be relevant to the student for them to be able to construct meaning (Biggs, 1996).

Research about RS reports beneficial effects for dimensions such as engagement (Blasco-Arcas et al., 2013; Han & Finkelstein, 2013; Henrie et al., 2015), motivation (Hunsu et al., 2016), and participation, most often as a result of expanded communication compared with traditional teaching (Keough, 2012). While students often consider using RSs during learning activities as an enabler for participation, there is consensus among teachers that the way a particular RS is applied is more likely a result of the perceived effects on participation rather than the RS itself (Einum, 2020; Ludvigsen et al., 2015).

Two systematic reviews that investigated the use of RSs in health care (Grzeskowiak et al., 2015) and pharmacy education (Hussain & Wilby, 2019) show slightly different results. In both reviews, students were positive because RSs encouraged participation, engagement, enjoyment, and attention to content. In the health care education review, improved learning outcomes were noted when comparing the use of RSs in teaching with one-way lecturing, but not when compared with interactive lectures with integrated questions. In the pharmacy education review, educators appreciated using RSs in teaching but preferred not to use RSs for graded assessments. Furthermore, the pharmacy education review pointed out that few studies investigated the impact of RSs on course grades, and those that did reported mixed results. Positive effects on student recall were found immediately after educational activities but were not lasting.

3. Method

When designing this research study, it was important to consider the perspectives and experiences of the teacher educators in order to gain a more in-depth understanding of their experiences of using RSs in their teaching. Since the aim of the study was to explore teacher educators' perspectives, experiences, and thoughts in detail, we chose to conduct semi-structured interviews. The rationale for conducting interviews was that it allowed open-ended questions and probing for more information to gain a rich, nuanced understanding of the topic.

3.1. Data collection

In order to address the research questions, semi-structured interviews were conducted with nine teacher educators employed at seven different Swedish higher education institutions in 2021. The teacher educators contacted were invited to participate in the study via email, where the purpose of the study was explained – to explore for what purposes teacher educators use RSs. It was also clarified that we were looking for teacher educators with experience in using RSs, and some examples of online RSs were provided for context.

A chain-referral method, or snowball sampling technique, often used when researchers are studying hard-to-reach populations, was used to find study participants (Cohen et al., 2018), Even though snowball sampling is a non-probability sampling technique, it can be an efficient way to recruit participants, particularly when studying small or, as in this study, specialized groups. We identified a small number of individuals with the characteristics we were interested in: teacher educators with experience in using RSs. These were then used as informants to identify or put us in contact with other teacher educators who qualified, and these, in turn, identified yet others.

We initially identified four teacher educators at three Swedish higher education institutions with a teacher training program corresponding to the characteristics. Three of the four teacher educators agreed to be interviewed. All four provided us with six names who, in their opinion, corresponded to the description. Finally, three more teacher educators agreed to participate in the study.

The teacher educators included in this study represent 7 of the 26 higher education institutions with a teacher training program in Sweden. Even though the nine teacher educators in this study represent a small selection, we considered the combination of the teacher educators' geographical variation, equally spread from the north to the south of Sweden, the size variation of the higher education institutions, their range of prior experience of working as a teacher educator (3–32 years), using RSs in teaching (2–14 years), frequency of use of RSs in teaching, and their subject discipline, which provided us with interviewees with different backgrounds and experiences.

The interviewees all considered themselves more or less experienced users of RSs in a teacher education context and were willing to be interviewed for this study. The data collection, storage, and analysis of the study were implemented in accordance with the ethical guidelines related to the demands on information, consent, confidentiality, and usage set by The Swedish Research Council (2017). All participants were informed about the purpose of the study and how the data would be handled. They all provided consent in writing before the interviews were conducted.

Before the interview sessions were completed, a semi-structured interview guide containing 18 open-ended questions was prepared. For instance, the questions related to the teacher educators' background (For how long have you been using RSs?), purposes of using RSs (What RSs functions do you use in what situations/settings? What is the intended purpose of using RSs?), and their reflections regarding advantages and limitations (What are your experiences connected to advantages/limitations of using RSs?). The interviews were conducted and recorded via Zoom due to the geographical distance and the pandemic situation.

3.2. Data analysis

Since we were interested in the teacher educators' experiences, we chose to analyze the data set using thematic analysis to identify, generate, conceptualize, analyze, and report themes (Braun & Clarke, 2006, 2019). Data were analyzed using an inductive approach. Even though we had some insights into RSs research in higher education, we did not have a predetermined set of codes when starting the analysis.

First, we prepared the data for coding by transcribing the interviews (281 min in total) in Swedish, and initial ideas, impressions, and observations were noted. Thereafter, in the second phase, we carried out initial coding, where we sorted and divided important short phrases or words that represented specific concepts in the data. These include (but were not limited to): communication, interactivity, evaluation, preparation, democratic values, contact, relationship, technical challenges, and open-ended/multiple choice questions. In the third phase, we interpreted and discussed the teacher educators' answers to conceptualize themes. In the fourth phase, we discussed the themes to validate them in relation to the coded extracts. In this phase, we aimed to structure the themes into ''advantages'' and ''limitations'', to relate to our research questions. However, since the identified themes brought up both what we identified as advantages and limitations, we decided to reorganize the structure of the result section in this paper. Instead of clustering the themes in the subheadings ''Advantages'' and ''Limitations,'' we decided to present the advantages and limitations of each theme. The themes were then named and defined. In the final phase, illustrative quotes related to the themes were selected and translated into English, and then we produced the report. The themes are presented in more detail in the result section below.

4. Results

The teacher educators in this study mainly used online RSs in which the teacher students could use their computers or smartphones to either write or record their answers anonymously. The purpose of choosing this kind of RSs was to enable all students to be able to participate through different devices (e.g. smartphones, computers, tablets).

All teacher educators had the experience of using RSs during in-class teaching in synchronous learning activities where either the teacher educator or the students asked questions and submitted comments or answers through the chosen RS. Typically, during the seminars, there were 20–30 students present. However, some teacher educators used RSs during lectures with hundreds of students. A few teacher educators used RSs in online or hybrid teaching as well.

Below, the identified themes from the thematic analysis are described. The teacher educators describe purposes, advantages, and limitations in relation to the themes.

4.1. The teacher educator as a role model for teachers

All teacher educators highlighted what they referred to as the dual task of teaching teacher students. They used RSs to exemplify how to use digital tools to promote students' learning, for instance, by changing the roles and letting the students reflect on their learning:

> It is about breaking the structure of the traditional teacher-student relationship. Or not break it completely but loosen it up a little bit. And activate students more in their own learning process. That's where I think [RSs] are useful. (Teacher educator 3)

The teacher educators emphasized the need for teacher students to understand the intended purpose of using RSs in learning activities to be able to motivate the use of them. The purpose of reflecting on using RSs in teaching was important since the teacher students, in their future profession, will need to balance between providing their own knowledge and letting the students share theirs:

> What I think is the most interesting and what I mostly use [RSs] for is to disconnect me as the one who possesses the knowledge and the one who shows what is adequate knowledge and instead try to give that role to the students. (Teacher educator 4)

Some teacher educators mentioned the importance of taking advantage of all students' competence and previous knowledge to transfer the teacher from being the only one who possesses knowledge – a valuable skill in the teacher students' future profession, in which a student-centered learning usually is an important aspect.

4.2. Feedback to evaluate teaching

A majority of the teacher educators explained how they used RSs to gather student feedback to assess and modify the teaching to meet students' prerequisites and needs, in accordance with formative assessment: "To me, an RS is a tool to get feedback on my teaching. Or for the students to get feedback on what they do" (Teacher educator 8). Seeing how RSs could be connected to formative assessment was considered valuable for the teacher students in their future professions. All teacher educators highlighted that using RSs was a way to work with different formative strategies. Depending on the teacher educators' questions, they described how to capture what the students understood, what difficulties they had, and what they needed the teacher educators to elaborate on.

Some teacher educators instructed the students to answer or pose their own questions in an RS before a seminar. For example, at the beginning of seminars, the students could brainstorm connected to a specific subject, and the words were visualized in a word cloud using an RS. Another example is to use RSs for diagnostic motives to get a picture of preconceptions and misconceptions. A scenario was described where the teacher educator planted misconceptions into statements to see if the students could spot similarities between reasonable answers or method choices.

4.3. Anonymity

The function of being anonymous was frequently used when using RSs synchronously during seminars and lectures. The possibility of being anonymous encouraged the students to participate and

engage in the discussion since they were able to express questions and comments without having to explain or defend their viewpoints at an initial stage. This function was valuable since the teacher educators often wanted the students to write open answers.

> But then there are some students that are not at all as comfortable with appearing by name, and for them, it is probably good that they can be anonymous. And hopefully, in the long run, it will result in them not having to be anonymous anymore, so I think it's an advantage that you can get both. […] It is great that the alternative of anonymity exists. (Teacher educator 2)

Also, the possibility of being anonymous when using RSs contributed to the teacher students' reflections on pedagogical choices related to learning processes, as illustrated by this quote:

> They also learn that it is not a good idea to ask 'Has everyone understood?', and then 'Okay, let's continue.' without giving the quiet pupils and students a chance to actually respond. To give them the chance to express themselves, to access them in some way. (Teacher educator 9)

However, some teacher educators highlighted that anonymity might also be a limitation. Some teacher students tended to avoid arguing for their opinions since they did not have to follow up on their comments. In rare cases, students could also leave irrelevant, provocative, or disturbing comments.

> The disadvantage is that you can hide … You do not have to stand up for what you think … You can sort of be another person … (Teacher educator 8)

4.4. Participation

Both the more and less experienced teacher educators emphasized how RSs could be used to stimulate students to actively participate in discussions during smaller seminars and larger lectures by being able to add their own comments and answer or pose questions. They described using RSs as tools to increase student participation and invite the students to contribute to the discussion, often by using the open answer function, where the students could write their own answers.

They brought up the benefits of interacting with a large number of students during a lecture by gathering and presenting different perspectives. During the larger lectures with more students present, the purpose was to either interact with the students or let them interact with each other. In this context, both open answers and multiple-choice questions were used.

> […] there is more participation – it will be much better interaction at a lecture where they can provide some type of input than if they just sit completely silent. (Teacher educator 9)

The teacher educators also described how RSs had beneficial effects in smaller groups with 10–20 students. In the smaller groups, the students usually felt more secure asking or answering questions or adding comments. The purpose of using RSs during the seminars with fewer teacher students was to engage, activate, and involve the students in the learning activities. Several teacher educators emphasized that the use of RSs contributed to more participation since the teacher students felt more comfortable writing a comment in the RS than raising their hand during an in-class or online seminar:

> There is a lower threshold to write something in a response system than to raise your hand and/or turn on the microphone. So […] you offer them a way to influence quickly. Even if I say that you are very welcome to interrupt my lecture, they [the teacher students] rarely do. There are a few students who dare to do so. So [the RS] gives them an option to make an immediate impact. (Teacher educator 9)

Some of the more experienced teacher educators reflected on the fact that for the use of RSs to be beneficial, the students need to be in agreement with the purpose of using RSs. The students need to be willing and prepared to participate. If the students do not participate, the group is not able to elaborate on the answers, which might be challenging: "I thought that (the RS) was great, but it's

based on the fact that all students need to be engaged and willing to use the RS. And not everyone is, and then you lose them" (Teacher educator 5).

4.5. Flipped classroom

The teacher educators who used RSs during whole group lectures with hundreds of students referred to the practical benefits: "I can not ask 100 people for their views on 'the most significant challenge'; I have to find another way to capture it" (Teacher educator 1). These teacher educators referred to the idea of *flipped classroom* and *peer instruction* to explain the arrangement. Some of them usually provided the students with a video clip before the lecture, and during the lecture, they posed questions and different answer alternatives using an RS. First, the students answered on their own and were then able to discuss their answers. They then answered using the RS again, so the teacher educator could show everyone's answer and bring up common misconceptions or errors.

The same teacher educators occasionally used RSs to let the students answer or pose questions *before* the seminar or lecture, in accordance with the idea of *flipped classroom*. The students usually watched a video clip, carried out a quiz, or answered or posed questions in an RS before the seminar. The intended purpose was to investigate the students' previous knowledge to plan seminars/meetings based on the students' prior knowledge and spend more time discussing and solving problems.

4.6. Time aspect

Several teacher educators highlighted that using RSs could be a time-saver when carrying out real-time evaluation, quick check-ups, and receiving feedback from the students, both with larger and smaller groups of students, to identify a starting point to bring up for a joint discussion. They also emphasized that using RSs during more creative workshops could facilitate the documentation and the exchange of initiatives.

> I have used RSs to quickly get an idea of the students' different perceptions of a concept or a method because it was time efficient. I could ask a diagnostic question and then: 'Bang! Good!' It's like a quick, effective exit ticket. (Teacher educator 6)

However, they also pointed out that the implementation time sometimes was considered a limitation due to, for instance, lack of prior experience and interest. For instance, sharing and finding the correct link and code to join an RS session could be time-consuming. The implementation time sometimes made the teacher educators reconsider whether they thought it was worth the effort.

Also, the teacher educators brought up the time issue regarding how long the students are allowed to think and formulate themselves when using RSs. Using RSs is not appropriate for all students since some students are used to and prefer to keep the dialogue in discussion boards or forums in a virtual learning environment in which they are able to think for a longer time before they publish their comments. Many identified a challenge regarding allowing more time for the students to think and write:

> It's limiting that you have to be pretty fast anyway to go in and write. I don't think that so many teachers actually wait that long when you have asked [the students] to go to a link to a word cloud and such. (Teacher educator 9)

The time issue was also connected to the teacher educators' preparation time. They emphasized that creating relevant and interesting questions or quizzes for each lecture or seminar was challenging, whether the questions were of open-ended or multiple-choice character:

> Obviously, it is difficult to include too many multiple-choice questions [because] if you have to create many good multiple-choice questions, it takes an awfully long time. (Teacher educator 7)

Several teacher educators emphasized that along with the time aspect, it might also be didactically challenging to formulate relevant questions. Instead of using RS as a control system, open-ended answers stimulated a more open reflection and discussion. They usually used the open-ended answer alternative where the students could write their own answer, rather than the multiple-choice answer alternative, where the answers were already formulated:

> It is more challenging to use multiple-choice questions if you are to evaluate something. The risk is it will be governing and leading. I want their own words in a completely different way. (Teacher educator 4)

They pointed out that RS could enable the students to ask more questions instead of just delivering correct answers: "Working this way, the students ask more questions, which is important. Sometimes they ask strange things, and that's great!" (Teacher educator 2)

4.7. Ethical aspects

The teacher educators brought up a few different ethical aspects connected to using RSs. Several highlighted the ethics related to the students' integrity and consent. Although being aware of specific regulations, such as the General Data Protection Regulation of the European Union (EU General Data Protection Regulation, 2016), which stipulate what RSs and functions they are allowed to use, far from all teacher educators strictly followed the regulations: "Or – we are still not allowed to buy [a specific RS] due to GDPR, so I buy it myself … " (Teacher educator 4)

Another ethical aspect that was addressed was connected to the relationship between the teacher educator and the teacher students when using RSs. The teacher educators reflected on what knowledge was considered "desirable", how to develop it and how to examine it. They highlighted that using RSs as tools for controlling or testing might be problematic since the teacher students might learn that being knowledgeable always corresponds to knowing the correct answer:

> There is a risk that it is used in another direction. […] Just testing, testing, testing: 'Do they get this now?' Like 1, X, 2 … No, then it will not be good. […] I think there is a risk too: 'Oh, but how convenient, then we just insert a test here to see if they get it. It's like reducing knowledge to just some right answers. (Teacher educator 4)

A final ethical aspect that arose was connected to commercialization. There are companies with a profitable idea behind most RSs. Some teacher educators considered it problematic since they did not want to contribute to the market by choosing specific tools on their own, even though their institution usually paid for them: "Then we have the fact that [RSs] are connected to some kind of market. And then it becomes complicated … " (Teacher educator 4) A dilemma was that they wished for the purchases to be more centrally controlled, even though they wanted to be a part of the purchasing process since they had insights regarding the advantages and disadvantages of different digital tools. However, their concerns were connected to the fact that the responsible persons typically were not familiar with their reality: "Many schools spend a lot of money on digital equipment without taking the teachers' needs into consideration" (Teacher educator 6).

5. Discussion

In the results of this interview study, the teacher educators describe the purposes, advantages, and limitations related to the identified themes. Below we organize their answers to discuss the research questions.

5.1. RQ1: for what purposes do teacher educator describe that they use RSs?

All teacher educators agreed that one of the primary purposes of using RSs was to encourage student participation and make the students more active during learning activities, which was considered a vital part of the students' learning process. In the teacher educators' opinion, active student participation usually led to better discussions and improved student learning, which is

supported by previous research (Chan et al., 2019; Hrastinski, 2009; Stowell & Nelson, 2007). Almost all teacher educators considered student participation a crucial part of the learning process, whether they used RSs or not. An important note was that almost every teacher educator used open answers more than multiple-choice questions, regardless of the group size. In the context of using RSs, this procedure is worth noting since much research connected to RSs (Caldwell, 2007; Chan et al., 2019; Stowell & Nelson, 2007) focuses on how multiple-choice questions are used with larger groups in lecture halls. The teacher educators' purpose of using open answers more than multiple-choice questions was to stimulate a discussion among the students connected to the learning activity, but also to exemplify how to use RSs to expand classroom communication, a beneficial effect of using RSs, according to Einum (2020).

Several teacher educators emphasized that their pedagogical experience and competence were important factors when they analyzed for what purposes and in what situations they chose to integrate RSs in their teaching. As mentioned in the method section, the teacher educators' experience and their ability to stress both advantages and limitations connected to each theme was the reason why we chose to reorganize their answers in the result section. They accentuated their distinct "meta (dual) task" of teaching teacher students, where all strategies, methods, and (digital) tools presented and used during seminars often served as examples, which the students could bring to their own teaching. According to the interviewed teacher educators, this dual task of teaching is unique. Using RSs during learning activities was described as a "meta-purpose" since the use of them, both explicitly and implicitly, could serve as a starting point for a further discussion about teaching in general and, more specifically, about how digital tools can be used during learning activities connected to formative assessment and student participation. Also, if irrelevant or disturbing anonymous comments arose, the teacher educators could introduce a discussion with the students about how they would handle similar situations with their own students. Even though the anonymity might be challenging in some groups, the teacher educators, in accordance with previous research (Caldwell, 2007; Hunsu et al., 2016; Stowell & Nelson, 2007), underlined that the students tend to participate more when they are able to be anonymous.

Moreover, almost every teacher educator explicitly or implicitly referred to formative assessment to explain and motivate the use of RSs. For instance, to use the students' responses and feedback to modify the teaching to meet the students' pre-conditions and needs. This reasoning is emphasized by several researchers (Beatty, 2004; Black & Wiliam, 1998; Poulis et al., 1998), who also stress that identifying the students' strengths and areas of improvement is an important part of teaching since it helps the students to process their own learning.

5.2. RQ2: what advantages and limitations do the teacher educators experience regarding RSs?

Although several teacher educators pointed out that they occasionally lost valuable time due to technical issues or were limited by specific regulations, a clear majority considered most RSs as flexible tools to use in teaching. They appreciated the possibility of quickly posing questions and gathering students' answers, which they used as starting points for discussions, and to evaluate their teaching. However, many also accentuated the challenge of creating engaging, high-quality questions, whether they were of open-ended or multiple-choice character, which according to previous research (Beatty, 2004; Beatty et al., 2006; Biggs & Tang, 2011), is a recurring issue. Also, they underlined the difference between using multiple-choice questions with given answer alternatives vs. open answers where the students write text since they tended to answer multiple-choice questions faster than writing their own answers. However, most teacher educators stated that, despite the time aspect, they usually preferred to use the anonymous open answer alternative in the chosen RS to enhance discussions. That way, the students were given the possibility to contribute their perspectives anonymously, which, according to the teacher educators, made their comments more honest and forthright. To be able to take part in several perspectives was by many teacher

educators considered valuable for the students' learning. However, the teacher educators pointed out that when using an RS where all students can see each others' answers, they needed to be prepared to bring up the more uncomfortable comments for discussion. This was also a part of what they referred to as the dual task since the teacher students, presumptively, will handle similar situations with their future students.

5.3. Limitations of the study and further research

This study is a contribution to the research of using digital tools in a teacher education context. More specifically, it explores for what purposes teacher educators use RSs, and what advantages and limitations they experience. Although the nine teacher educators interviewed in this study represent a small selection and were all active at Swedish higher education institutions, we consider their teaching experience and using RSs relevant to address the research questions. Future research could further explore why and how RSs are used in the context of teacher education internationally.

6. Conclusion

This study aimed to explore experienced teacher educators' experiences of using RSs in their teaching. This was done by interviewing teacher educators and analyzing their answers using thematic analysis. The result showed that, in contrast to previous research related to the use of RSs in teaching contexts where multiple-choice questions with larger groups are frequent, the teacher educators in this study used RSs in both smaller and larger groups. In addition, a majority chose to use open answers rather than multiple-choice questions, often to support social interaction and more vivid discussions and exchange of ideas among the students. This aligns with a socio-constructivist perspective on learning, which posits that knowledge is not simply transferred from a teacher to a student but rather is constructed through social interaction and collaboration. Although limitations connected to technical and ethical issues, significant purposes of RS use were identified; enhancing student participation during learning activities in the teacher training program and exemplifying how to use digital tools to evaluate and support fundamental parts of teaching, for instance, enabling and facilitating student participation, co-operation, interaction, dialogue, and feedback.

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