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Preparing Educational Hackers

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Abstract

As technology creates change at a faster pace than ever before, education battles to remain relevant. With no one right way to design schools, some teachers are *hacking*—that is, acting innovatively—in the public K-12 system. This chapter discusses a qualitative research aimed at examining characteristics and conditions under which teachers hack their classroom pedagogy in disruptive innovation, emphasizing the study's implications for teacher education. Participants were eight public school teachers from Massachusetts with more than 1 year experience in the profession, working in the classroom at the time of the study, and demonstrating pedagogic innovation. The results show recurring notions connected to teachers as hackers, their professional identities, the ways they act, and common characteristics of idealism, motivation, reflection, adaptation, and resourcefulness. The framework of *hacking* to describe innovative actions of public school teachers adds to existing terminology and offers a fresh lens through which to view and re-structure teacher education. The recommendations can serve as a north star for preparing teachers to reform the twenty-first century public school system from within.

Keywords: innovation, hacking, teacher education, risk-taking, educational revolution, change

1. Introduction

The public education system has always struggled to keep pace in the changing world. In the twenty-first century, as technology creates change at a faster pace than ever before, education battles to remain relevant. In such an environment, with no one right way to design schools, some teachers are *hacking*—that is, acting innovatively—in the public K-12 system.

A few presuppositions guided this research: (a) The world has changed and the public education system should change accordingly, (b) there is no single way to design schools in the

twenty-first century, (c) teachers should change the public K–12 education by creating disruptive innovation in pedagogy, and (d) teacher education should play an important role in preparing teachers to lead the educational revolution.

Several terms, such as leaders or change agents, have been used to describe teachers who take initiative and change their teaching practices. When the term leadership is applied to schools, it most often refers to teachers who accept additional formal roles, such as mentoring new teachers or leading team meetings [1, 2]. Another frequently used term, teachers as change agents, represents teachers who influence others in the organization through their actions [3]. I present a new term, *teachers as hackers*, to describe the actions of teachers in the K–12 public system who reform and act innovatively in their practice without such formalized leadership or administrative role.

The term hacker often suggests someone who seeks and exploits weaknesses in a computer system or network. During the past decades, the term has had meanings both negative—referring to criminal activity—and positive, in the sense of using playful cleverness to achieve a goal. In other words, “hacking is simply taking something—like an object or idea—and changing it to fit one’s own need,” ([4], p. 1). Along with the positive meanings comes the term *hacker culture*, which combines excellence, playfulness, cleverness, and exploration in performed activities [5].

In this positive context, teachers’ innovative behavior that has the power to reform the public education system can be described as hacking schools. Hackers tend to find weaknesses, create solutions using existing resources, and collaborate with others. They are passionate professionals, enjoying what they do [6]. Thus, this notion of hacking can relate to teachers who continually look for ways to reach their pedagogical goals and act accordingly, and are playful and passionate about their work.

This chapter discusses a qualitative research aimed at examining the characteristics and conditions under which teachers hack their classroom pedagogy to create disruptive innovation in the public education system, [7] and emphasizes the study’s implications for teacher education. The study’s recommendations can help policymakers and higher education leaders transform teacher education programs to better prepare teachers to reform the twenty-first century public school system.

Teacher education has become a central concern nationally and internationally as many countries pay increased attention to teacher quality and preparation [8–11]. In the context of this chapter, *teacher education* refers to the teacher preparation that occurs before teachers enter the workforce. This may include traditional four-year college preparation, as well as alternative programs inside or outside higher education institutions. It can be a program for novices or for career changers. Being innovative in teaching regards introducing new practices or methods of teaching, assessment, or communication. The innovation usually includes risk-taking and entrepreneurship on the teachers’ part, meaning it is innovative for the teachers individually or in their environment.

The goal of the research discussed in this chapter was to obtain a comprehensive understanding of the experience of public school teachers who act innovatively in their classrooms and broaden understanding of innovative teachers in public schools [7]. Abundant material in

the literature addressed *obstacles* to change in the public education system; [12–14] this study focused on *opportunities* to change and learn from teachers' success stories. As such, this chapter addresses the research questions: *What are the characteristics and circumstances of teachers who hack the pedagogy in their classrooms? What lessons for teacher education can be adopted from teachers who hack?*

2. Teachers as hackers

2.1. Method

Answering the research questions required understanding of the complex experience of innovative teachers that qualitative research methods provide. Questionnaires were used as a pre-interview screening for participation criteria and to obtain background information prior to the interviews regarding participants' higher education, professional experience, teaching certifications, and current work. However, semi-structured interviews were the main data collection tool. A university internal review board approved all research procedures, including consent forms, questionnaires, and interview questions.

The study participants were eight public school teachers from Massachusetts who met all selection criteria, including more than 1 year experience in the profession and working in the classroom at the time of the study. Most significantly, all participants met the criterion for demonstrated pedagogic innovation. They had explored new ways to teach or incorporate nontraditional methods such as innovative class design, project-based learning (PBL), new assessment tools, interdisciplinary perspective, or technology integration into their teaching. These innovative actions and pedagogical explorations were individual efforts and not part of a broader reform. For the final criterion, all participants perceived the experience as successful. The sample was diverse, with participant teachers from a variety of school environments, subjects, professional backgrounds, ages, and years of teaching experience.

The interviews took place in the participants' workplace (schools), lasted 60–90 minutes each, and were audio recorded. Following the interviews and the transcription process, I uploaded the data to NVivo software to support data analysis. Adaptive grounded theory inspired the analysis, and I approached the data with no prior coding or categories and with an open mind regarding potential findings. I coded each transcript and added codes as needed. I read each transcription several times, immersed in the data, then coded, re-coded and arranged the codes in thematic groups. For example, I grouped codes regarding time, space, and support under the theme, *resources*. Further, I conducted progressive analyses such as text searches, matrix coding, and word frequency using the software to look for additional findings.

2.2. Results and discussion

The results showed recurring notions connected to teachers as hackers, their professional identities, the ways they act, and their common characteristics. **Figure 1** lists the skills and habits of teachers who act as hackers identified in the findings.

Characteristics of Teachers Who Hack Their Pedagogy

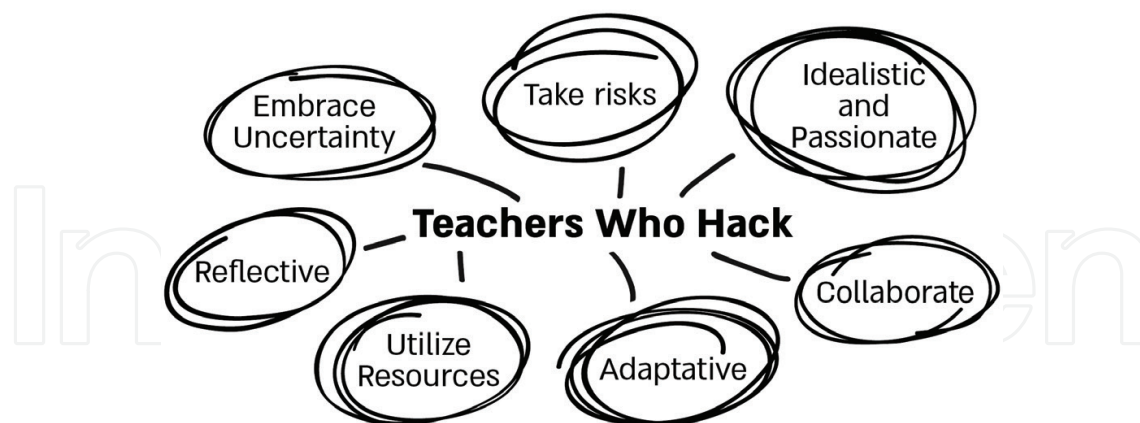


Figure 1. Skills and habits of teachers who hack.

Teachers who hack had personal traits and habits such as reflection and risk-taking and used their diverse backgrounds to influence their practices. They were highly motivated to improve their teaching processes. Unsatisfied with being “just” good teachers, teachers who hack were driven to explore new ways of practice. In this process of exploration and improvement, they took risks and wisely used the resources around them to reach their goals. They reflected on their accomplishments, accepted failure as part of the improvement process, and acknowledged the endless possibilities technology offers when it comes to changing their pedagogy.

Teachers who hack were willing to act in uncertainty and accept that there are many possible answers to the question of how education should be conducted in the twenty-first century. They were driven to share their new pedagogy with others inside and outside their schools, even when they faced challenges doing so. They appreciated the support of administration, the organizational culture of collaboration, and the importance of available resources such as time, technology, and space.

The study findings have meaningful implications for teacher education. Awareness of the habits of teachers who hack identified in the study can help designers of teacher-education programs reframe and modify curriculum and structure choices to promote opportunities for future teachers to hack their pedagogy. Thus, based on the mental habits and concrete practices of teachers who hack, I established guiding elements and recommendations to address questions and dilemmas regarding teacher education programs and integrated these recommendations in the following discussion.

2.2.1. Idealism and passion

I want to help people integrate technology. I feel passionate about it, like I want the kids to have these experiences.

Teachers who hack their pedagogy were passionate, idealistic, and opinionated. They loved the profession. As a veteran teacher participant acknowledged, “The longer I’ve been here, the longer I love it. It’s not going down; my love for it is increasing, my desire.” With strong

feelings and beliefs regarding the role of education in society, these teachers cared about issues at the heart of the educational debate, such as common core or testing, and the ways they expressed concern demonstrated their emotional investment. For example, one participant showed emotional investment, saying, “It was this factory-model thing driving me nuts.” They also tended to be involved in issues outside the classroom, such as the role of education in social justice issues such as education for underprivileged kids, race, and gender.

In his book, *The Element*, Robinson wrote about how finding passion changes everything [15]. The concept applies to teachers. Preparation programs should help students find their passion and purpose, devoting time and effort for them to identify and understand what they care about—from sustaining good writing skills or special education to social justice and environmental issues.

The teacher-preparation process should encourage future teachers to deal with philosophical questions and critical thinking regarding the role of public education in society [16]. Programs should encourage students to form their individual identity as educators and answer questions such as, *Why am I a teacher?* This process need not conclude at the end of the program; it is a beginning, familiarizing students to a habit of thinking about higher goals. Teachers who care deeply about education will be more motivated to choose public systems, change it from within, and stay in the profession.

2.2.2. Motivation and background

I have an innate desire to compete and be the best at the thing I am trying to do.

The findings indicated that participants frequently raised issues related to motivation—motivation to enter the profession and motivation to act innovatively and hack their pedagogy.

In the study, four participants’ first profession was teaching and four were career changers. A 23-year-old teacher explained he entered the profession because his teachers had influenced his life: “I became a teacher to make these kids feel like they are successful in something; to make them feel like they’re loved. And they want to be better people.” Other reasons participants gave for their career choice included the influence of parents and experiences from other educational settings such as summer camps. All four participants who had changed careers to enter teaching described a time in their lives when they realized teaching would allow them to feel more meaningful or more satisfied. For example, a participant who had been an engineer unhappy with that work realized the part he most enjoyed was training others—and then realized teaching children might be a better fit for him.

Participants also emphasized their motivation to act innovatively. One teacher described it as “wanting to be at the cutting edge and then always wanting to be doing something different and interesting that’s going to push my thinking.” In addition, participants shared that a reflective process regarding their educational goals—and even failure to reach those goals—was a source of motivation to explore new paths.

The hacker profile contemplates the desired profile of teachers accepted into teacher education programs and later to public schools. The application for teacher education programs

should identify candidates with personal traits and life experiences that can help them become hackers: individuals who demonstrate passion for education and motivation for social justice causes, who define themselves as creative and thinking outside the box, who have experience learning in nontraditional schools or with technology, and so on. Schools of education should broaden the spectrum of applicants and encourage candidates with diverse background to contribute their unique perspectives and skills to the teaching force. This recommendation aligns with the goal of U.S. public schools to diversify faculty by all means [17–19].

Another focus should be on career changers who enter teaching after starting their professional lives in another occupation. My study supports previous findings that showed the personal qualities and attributes career changers bring to the profession are likely to improve the quality of teaching and student learning. For example, Williams and Forgasz supported recruiting career changers in Australia because these teachers bring attributes such as maturity, life experience, work knowledge, skills from other professions and industries, and high levels of motivation that supplement those school leaders bring to teaching [20]. Teacher education programs should continue to create opportunities for career changers to enter teaching and consider what they need in their pre- and in-service training.

Study participants who had changed careers to teach stated it took them time to realize that some skills they acquired at other settings were relevant in schools. Previous research also indicated that teachers who enter the profession with a broader understanding of the goals of public education or a love of children perform better at their jobs [21]. Even first-career teachers participating in the study commonly referred to their previous educational experiences such as summer camps or volunteering. Jarvis perceived the individual as a “whole person made up of the mind and the body [who] comes to a learning situation with a history, a biography that interacts in individual ways with the experience that generates the nature of learning,” ([22], p. 101). From the perspective of adult-learning theories, individuals reflect mostly on the highly structured learning that occurs in classrooms or workshops but also have much to share about learning in informal settings. Teacher preparation programs should design strategies to allow students to bring their unique perspectives, habits, and skills from previous experiences into the conversation.

2.2.3. Teacher education pedagogy

It's good for students to see adults grappling with problems like that...As a kid, I thought teachers just knew everything.

Relatively new terms such as *online learning*, *blended-hybrid*, and *web-facilitated* environments have become part of the education jargon [23]. Teachers are expected to work and teach with new pedagogies such as project-based learning (PBL), self-directed projects, paper-free classes, and blended-learning teaching. The new pedagogies emphasize the importance of real-life learning, an interdisciplinary approach, and the use of technological tools to promote deep learning [24].

Study participants detailed the pedagogical hacking they initiated in their classrooms. A high school social studies teacher transformed her classes to be flipped and paperless. An

elementary school art teacher shared her interdisciplinary teaching, integrating science with art projects. A second-grade teacher in an urban school used mindfulness to support learning and classroom atmosphere. These teachers invested time and effort to look at a problem, learn, and explore new ways to approach their teaching. One participant explained, “I really believe in not doing the same thing twice. So, this lesson we didn’t do last year, and I probably won’t do it for another couple of years if I do it again—but there’s definitely a hundred things I will change about it.” Another participant added the issue of providing twenty-first century skills, saying when students memorize something, “that’s not education. That was education 1839, when our industrial revolution started. But it wasn’t—it’s not—education now.”

Such scenes of experimenting with new pedagogies and technology, however, are less common in higher education classrooms than in K–12 schools. Many programs for teacher education are still steeped in traditional methodology, which designates mandatory courses and electives in structured pathways that do not reflect the vision for twenty-first century schools. Instead, programs should incorporate more of the new ways of teaching that already exist in the K–12 system. These new methods allow student teachers to own their learning through independent studies and to experience as a student what it means to learn in a dynamic environment [25]. For example, students develop new skill sets while working on a project with other team members. They learn the benefits and limitations of PBL, behaviors to help coach and support students, communication skills, and other lessons such as dealing with conflict and failure [26]. Without such individual experiences, teachers who will teach using PBL will lack comprehensive understanding and, later in their careers, have a harder time leading their students.

Another example is blended-learning or hybrid courses. Programs should use technology to expose student teachers to various ways of teaching using the opportunities technology provides. Students participating in a blended-learning course will gain a much better sense of what is important, the structure of this teaching method, and ways to use opportunities to overcome the challenges inherent in online teaching. Updating teaching and program structure to mirror better what happens in schools will help student teachers face the obstacles. As Darling-Hammond and Bransford expressed, teachers who grew up learning traditionally and then were trained traditionally are still capable of changing their mindsets [27].

Among other priorities, participants stressed the importance of pedagogy that is relevant and connected to real life. They created learning experiences that encourage students to relate what they learned in real-life settings and designed opportunities to get away from the school and connect with experts in authentic work environments. The same should apply when looking at teacher education programs.

2.2.4. Field-based work

Most ($n = 6$) participants stressed the importance of being in the field and interacting with students and teachers early in the training process, and 45% of their comments regarding teacher education connected to being in the field. Three teachers described their fieldwork as the most meaningful part of their teacher-development training. One stated, “The most valuable, adaptive moments—my ability to adapt—came from working with kids. You can’t help kids until

you understand their thinking, and that doesn't come from a book. It comes from working, interacting, with a wide variety of students as much as you can." Participants also related time in the field to other program aspects, such as training teachers to set realistic expectations. As another participant described, "They need to be in the schools all the time. Too many people don't realize what they're getting into."

These results correspond with the literature that recognized the central and crucial role of fieldwork—time spent in schools and in classrooms [28–31]. Common expressions in the literature to describe field-based learning, *practicum*, or *student teaching* in teacher education included *key factor*, [32] *program capstone*, [27, 33] *culminating experience*, [34] *very important*, [35] *critical element*, [36] and *the bridge* between preparation for teaching and the beginning of a teaching career [37]. All of these expressions indicate the central role attributed to this method of training future teachers, which can play a significant part in developing future teachers' sense of engagement with and commitment to the process of reforming the public education system. The practicum is also expected to support teacher retention and to help novice practitioners adjust better to the profession. This experience can serve as a crucial period of teacher-identity construction with a possible change in self-perception and professional identity and, thus, can support constructing professional identities of teachers as change agents.

In my study, the teachers who had also shared that their mentors inspired and led meaningful learning and development experiences. Programs should structure meaningful time in the field accompanied by mentoring, support, and reflective practice. The mentoring should be well structured to provide opportunities for risk-taking and support exposure to progressive educational models [31]. Based on my study results, I highly recommend residency models that offer a full year in the field [38] or programs that take place entirely in schools.

Preparation programs should seek to place students in different schools and educational environments committed to discussing questions concerning their role in the twenty-first century public system. Experience in an array of classrooms and public, private, and independent schools can offer future teachers an opportunity to reflect about different ways to teach and practice schooling. Exposure to as many teaching styles and teaching roles as possible is a key factor. Such preservice experiences can also solve the issue of in-service teachers who, due to scheduling or workload issues, rarely find the opportunity to visit other schools and be inspired by them. In the study, three participants stated they had directed their own training by choosing different programs or selecting their practicum sites. One teacher shared that she received special approval to do a practicum with a teacher she liked but who had less than the required 3 years of experience. She explained and justified her choice: "I was like, that's the person I want to learn from." Thus, programs should allow greater freedom to student teachers who drive their own learning and development, allowing them to locate the right learning environment that fits their developmental needs.

Teacher education programs can and should serve as models, as real-life examples of the different methods of teaching and learning—teaching by using the methods they teach—as well as catalysts for reform in the K–12 educational system. The pedagogy of teacher preparation programs should model the one desired at the elementary and secondary levels—one that is relevant, engaging, and includes skills that will become germane later. Creating a teaching

culture that leads the way for innovation and creativity is important in any higher education program but has an especially crucial role when preparing the next generation of educational leaders.

2.2.5. Reflection

That is where I think my philosophy in education started to change, because I hated the way I was teaching it.

Teachers who hack continually reflected on their goals, methods, and progress. Their reflection identified gaps between the present and desired future, detected problems, and explored different means to approach problems. As one teacher described openly, “I’m still battling my traditional teacher self.” Teachers who hack devoted time to learning and acted to improve practices and outcomes. In this, my study results are consistent with the literature, which strongly recommended reflective practice as part of teachers’ learning and development, and which was supported by adult learning theories [21, 39, 40].

Darling-Hammond and Bransford emphasized the importance of reflection to the learning process because it helps student teachers find alternative strategies for the future and to solve problems [27]. Boz and Boz found that encouraging student teachers to reflect on their teaching and identify their strengths and areas for development within reflective practice was essential to learning [35]. Reflection enables future teachers to recognize the limitations of their personal assumptions, acknowledge other perspectives, consider the moral and ethical consequences of choices, and clarify the reasoning processes involved in making and evaluating decisions [40]. Reflection can also support student teachers to think about the different ways of practicing quality teaching and to examine innovative models for teaching other than what they had experienced so far [27].

The habits of reflection and critical thinking can be learned, applied, and accomplished. Teacher preparation programs should help prospective teachers develop the habit of reflecting by using structured assignments that require students to apply critical thinking and reflection to their own practices or to others they experience during fieldwork. Any segment of a teacher education program can incorporate the critical thinking skill of looking for gaps or problems. It does not require a special course; it requires special attention. Every subject future teachers should know can be processed through the lenses of critical thinking and reflection. For example, reflection regarding field observations might include a segment to help student teachers look at problems in the field and think of possible solutions. Student teachers can be asked to create their teaching identity, asking themselves questions such as, Why am I here? What benefit do I bring? What is meaningful about me that I want to bring into teaching?

Increasing the number of reflecting episodes and enhancing their depth will help future teachers adopt this way of thinking and carry it into their daily teaching routines. “Institutions that, in general, encourage the teaching methods and the process of modeling devoid of any historical context or at philosophical base that would encourage critical reflection and that would lead students to ponder what worked. What did not, and why?” ([16], p. 358).

Reflection and continual assessment can be accomplished both individually and as part of an organizational culture that supports collaborative reflection [41]—devoting time to it and valuing teachers who reflect and share their contemplations.

2.2.6. *Adaptation (uncertainty, flexibility, and risk-taking)*

As I get older, I realize that I do not want to subscribe to anyway one form of thinking.

In my study, participants expressed adaptation mainly regarding willingness to take risks, handle or even invite uncertainty, and flexibility. Teachers who hack in school expressed tolerance of uncertainty in many occasions and provided examples that demonstrate it. A teacher who was exploring PBL said, “I love the idea,...everything about it. But there’s nothing out there that really shows me what to do.” In an ever-changing world, those teachers embraced the understanding that today’s methods might be not relevant tomorrow and “that’s OK.” Participants discussed flexibility in two ways, first referring to the amount of freedom schools give teachers in deciding what and how they teach and second, addressing their ability to react to changing situations and conditions. The teachers were not expecting linear changes and welcomed the process itself. One teacher shared, “It’s like you plant this little seed....I don’t give tests, nothing happens. The sky hasn’t fallen, kids are happy.”

Darling-Hammond and Bransford also emphasized that teachers should be prepared to become “adaptive experts” who develop skills and knowledge continuously [27]. Khan referred to embracing uncertainty as the constant adaptation and acceptance that is the nature of teaching and learning today [42]. Indeed, to create change, one should avoid the status quo and “shake” the system [42, 43].

Teacher education programs should communicate to students that this uncertainty is part of the nature of the profession. Teachers work with individuals; no days will look the same and no lessons can be taught exactly as planned. Understanding this can liberate new teachers and support them in adopting a hacker identity.

Seven of eight participants spontaneously brought up the subject of taking risks, indicating they perceive this to be a central issue. One participant explained, “A lot of people I have interacted with feel worried about like, ‘What if I do something wrong?’ where[as] I definitely grew up thinking you just try it and if it doesn’t work, you try something else. You have to actually be quite confident in your ability to fail at things.” Another participant added that to be an innovator, “you have to be willing to fail in public.” This willingness to admit failure dominated, as most ($n = 6$) participants described their own failures.

The risk-taking concept and behavior was also well connected in the results to themes of pedagogy, innovation, and failure, making it an important characteristic of being an educational hacker. In addition to a personal inclination toward taking risks, this behavior seemed connected with experience and professional confidence. Risk-taking was not traditionally considered a quality of good teachers; nevertheless, it dominates in theories of change [44]. Robinson shared the story of Suzan Jeffers, who wrote the book, *Feel the Fear and Do It Anyway*, showing that fear can prevent people from entering a situation in which they feel threatened; [15] thus, they lose a possible learning experience [45]. Mezirow referred to similar emotions and claimed the first phase of a learning process is a *disorienting dilemma* [46].

Teacher education programs should expose student teachers to the benefits of risk-taking and create learning opportunities that require them to experience and practice taking risks. Analyzing success and failure stories, as done in business schools, can provide additional exposure. Dealing with failure is hard. It requires reflection skills and a trusting environment but, if done properly, can support teachers' growth and perceptions of themselves as risk-takers.

Clearly, taking pedagogical risks within the protected environment of higher education or the practicum is beneficial, but stimulating risk-taking comes with its own risks and should be implemented with forethought and restraint. For example, it may encourage teachers who do not have the required knowledge to take risks just for the sake of trying or innovating [47].

2.2.7. Resources and technology

When the study participants talked about resources, they referred to (a) actual resources such as time, technology, and space and (b) their abilities to obtain and proactively use those resources—meaning, teachers who hack did not necessarily have more assets but worked better with what they had. They maximized the use of existing resources or acted to access more for themselves and their students.

All participants mentioned time as an important and even crucial resource in their ability to hack their teaching. One stated, "I think it has a lot to do with whether or not you have the time to innovate and think about things and like trying new things." The resource of time was associated with other themes such as collaboration ("Being able to sit down and talk to your peers is so valuable"), and several teachers stressed that shared time, structured into the schedule, is necessary to collaborate with colleagues.

In addition to time, teachers who hack discussed technology and its connection with pedagogy, new skills, and communication and collaboration tools. Frequently (41%), participants raised issues related to technology juxtaposed with pedagogy. They shared examples of how technological tools supported their new pedagogies. For example, one participant gave her students a project that included making a book trailer and inserting QR codes (matrix barcodes) on their individual websites. Another teacher used an app called ChatterPix that can make a picture talk. She assigned the students a biography project in which they drew a picture of someone they had researched and then presented the talking picture in the classroom.

In my study, technology influenced participants' communication with students and parents and served as a personal development tool, a way to collaborate with colleagues, and a pedagogical tool in the classroom to support individualize learning. Teachers addressed technology in terms of the problems it helped solve or the goals it helped reach, as well as new challenges it embodied. Their ability to use technology also related to risk-taking. As one participant commented, "Innovating with technology is feeling comfortable with it."

The study findings regarding technology's central role in education reform corresponded with a plethora of recent reports, books, and articles [48–51]. Alan November, an international leader in education technology, made an important distinction between technology and innovation [51]. He illuminated that not every technology-based learning or teaching is innovative and stated that educators' focus should move beyond the device and toward the

design of learning. For example, adding a digital device to the classroom without a fundamental change in the culture of teaching and learning would not lead to significant improvement in student learning. Unless clear goals across the curriculum—such as the use of math to solve real problems—are articulated at the outset, one-to-one computing becomes “spray and pray” ([52], p. 1).

Teacher education programs have two strategies to influence teachers’ use of technology: They can teach about it or they can practice it. Similar to technology integration into schools, integration into teacher preparation must serve learning goals and not be conducted just for the sake of adding technology. Technology is not a tool; it is a platform for learning, sharing information, connecting, and communicating. Teacher education programs should aspire to integrate technology and digital citizenship practices into *everything*. University professors should serve as role models for good technology integration in everyday learning and teaching, allowing students in education schools to experience for themselves the advantages (and challenges) of technology integration and then practice it better as teachers.

Another good platform is the practicum phase. The university can encourage on-the-job learning for student teachers coupled in a mentoring relationship in schools. Universities can also choose to work with and in K–12 schools that face challenges and practice technology integration at a high level.

Teacher education programs should encourage students to reflect about their digital experiences in addition to their experiences as learners. This conversation can help future teachers take risks, try new methods, and develop their professional identities as teachers in the twenty-first century.

2.2.8. Collaboration and learning communities

I don’t think some people realize the importance....You don’t have to be in a bubble, like on an island by yourself.

Changes in the ways teachers act occur not only in the classroom. Participants in my study described relationships with others as generally positive ways to share ideas, accept failures, promote shared goals, solve problems, and brainstorm solutions. One aspect of working with colleagues regarded mentoring relationships. A young teacher described, “You start to realize again, okay I’m learning and eventually I will be where this person is after 35 years. So it puts you at ease a little bit, too.” This sentiment holds true not only for novice teachers. One participant stressed the importance of investing the time to create professional networks. Another described how communicating with others who do not necessarily think the way she thinks helped her clarify her own thinking and better articulate her pedagogic principles. A veteran teacher kept in touch with friends who worked with her at her last school to “bounce ideas off all the time.”

Teachers who hack tended to subscribe to blogs and were active members of Facebook groups, allowing them to both inspire and be inspired by educators from all over the world. They

understood the value of breaking the loneliness of teaching and devoted time and efforts to being part of a community.

The literature supported the benefits of collaborative practice as well. “The work of educators in schools is greater than the sum of the individual parts” ([27], p. 13). When writing about breaking the leadership roles, power stated that schools must see themselves as a part of “communities of practice,” [3, 18, 53] groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly [50]. Future teachers should have the habits and skills to collaborate as an integrative part of their actions.

A model in Australia included learning circles, or “learning communities of preservice teachers who are placed together in the same on-campus workshop and in the same school for their professional experience placement, and who meet regularly throughout the professional experience for professional dialogue.” ([32], p. 197) This practicum model positioned student teachers as responsible for their own professional learning and for contributing to a professional learning community, which differed from the passive role usually adopted in a traditional practicum. Le Cornu explained:

Each participant is not only to share their experiences and learning, but also to listen actively to their peers and ask enabling questions that will assist their peers to explore on a deeper level their own understandings of what they are learning ([32], p. 198).

The responsibility for taking an active role and guiding their own learning can help future teachers navigate an educational environment that is (or should be) continually changing.

Juxtaposed with the importance of collaboration, participants in my study depicted collaboration with colleagues as problematic. They addressed the complexity of maintaining collaborative relationships in their day-to-day school lives due to issues of time, technology, motivation, coordination, and space. Teachers who hack often described themselves in the school setting using metaphors such as “lone wolf” or “an island.” They discussed some loneliness as built into the teaching profession and some as part of the role teachers take upon themselves. Correspondingly, the literature acknowledged that many teachers feel the school and district organizational structures often discourage teamwork and that most teaching work is done alone [27].

Helping prospect teachers reflect on the difficulties and develop strategies to improve their ability to collaborate also has a place in teacher education. Thus, teacher education programs should encourage community-of-learner practices during teacher preparation. That way, students develop the habit of collaboration and understand the benefits of being part of a professional community.

3. Conclusion

Teachers who hack and can disrupt the public education from within are idealistic and adaptive and use resources effectively. The term *hacking* to describe the innovative actions of public

school teachers is a not perfect description. Even so, it offers an addition to the existing terminology of teachers as leaders or change agents by acknowledging the risk-taking, creativity, and open mindedness needed to lead change. The change in term from *innovators*, *leaders*, or *change agents* to *hackers* is not merely semantic. It reflects the change in skills teachers need today—skills that must be recognized, practiced, and improved. As such, teacher education programs should:

- a. **Provide** students opportunities to be learners in nontraditional environments using progressive practices that serve as models for and enhance the use of twenty-first century skills.
- b. **Expose** students to different school systems worldwide.
- c. **Encourage** students to think critically about the philosophical issues and social goals of education in a democratic society.
- d. **Design** pedagogical experiences and spaces where students will be required to take risks, experiment, receive feedback, and develop.
- e. **Emphasize** and practice skills for twenty-first century teaching, such as reflection, problem solving, technology integration, collaboration, and life-long learning.
- f. **Embolden** students to develop their personal identities and goals as educators.

This chapter offers a fresh lens through which to view and restructure teacher education and school organization to support the desired revolution in public education. As one participant phrased, “When you’re hacking, you’re doing something that is not quite traditional, exactly, and that confronts tradition. It could be playful.” I could not agree more.

Thanks

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