Investigating the Teaching and Assessment Experiences of Maine Secondary Science Teachers During the COVID-19 Lockdown

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INVESTIGATING THE TEACHING AND ASSESSMENT EXPERIENCES OF
MAINE SECONDARY SCIENCE TEACHERS DURING
THE COVID-19 LOCKDOWN

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A THESIS
Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Science
(in Teaching)

The Graduate School
University of Maine
August 2022

Advisory Committee:

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INVESTIGATING THE TEACHING AND ASSESSMENT EXPERIENCES OF MAINE SECONDARY SCIENCE TEACHERS DURING THE COVID-19 LOCKDOWN

By Anupam Raj

Thesis Advisor: Professor Michael C. Wittmann

An Abstract of the Thesis
Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science (in Teaching) August 2022

In March 2020, an unexpected event changed the educational systems throughout the world. In the United States, the COVID-19 pandemic caused public places to close down, including schools. To continue education, schools in Maine went online. This study describes how Maine secondary science teachers taught and assessed their students while teaching remotely for the first time during the lockdown. It does so by investigating teachers’ perspectives about the impact on their students, how they handled the issue of equity, their new priorities and expectations, their teaching and assessment challenges, and their successful strategies during the initial phase of the lockdown. Apart from experiences shared by all teachers (N=10), the differences among the experience of teachers in high socioeconomic status (SES) schools (called affluent) vs the low-SES schools (called high-need) has been analyzed.

For this qualitative research, semi-structured Zoom interviews were done with voluntary participation from secondary school teachers who were recruited through a snowball sampling method. A phenomenological approach was used in this research to capture the overall experience of teachers and to make meaning out of it, resulting in five themes. A comparative coding process to better understand the phenomenon was utilized to compare and contrast teachers in affluent schools vs high-need schools through the five themes. In addition, an open coding method, inspired by the grounded theory approach, led to seven emergent findings, which further describe nuances of the five overall themes.
Results show that teaching and assessment were affected significantly during the Spring of 2020. Students were impacted greatly in all schools. In the wake of this impact, teachers shifted their priorities to the well-being of students rather than academics. To be more fair and equitable, they reduced their academic expectations and focused on being more available to support students. Moreover, the grading system (or in some cases criteria) was relaxed. Thus, teaching rigor was reduced, and assessment got streamlined.

In the Emergency Remote Teaching (ERT), lessons shifted more towards content than practices, and teachers tried to do new engaging lessons to retain student engagement. Teachers struggled with informal formative assessment and also with active learning. For many teachers, student engagement and attendance declined with time. Teachers were not very satisfied with their teaching as they were challenged with technology, exhaustion, family responsibilities, and not being able to help struggling students as usual. Participants also shared what they were grateful for, things they learned, and their future plans to support student learning.

This study highlights the inequity in Maine schools that was exacerbated during the lockdown. Teachers in high-need schools reduced their expectations a lot more than affluent schools because their students were more severely impacted, and they did not receive the same parental and administration support as affluent ones. The grading system was another limiting factor for high-need schools. There were significant differences in the two categories of teachers in terms of their challenges, strategies, and future plan. The role of parents became more important than ever before as students worked from home. All teachers persevered in the face of various challenges, tried new strategies, and did their best to support their students.
DEDICATION

This thesis is dedicated to
all the people who lost their lives
due to the COVID-19 pandemic.
ACKNOWLEDGEMENTS

First and foremost, I would like to thank my advisor Michael Wittmann, without whose constant support and care in my time at the University of Maine, I would have never written this thesis. Thank you for encouraging me to dream big. This thesis is very important to me. Next, I would like to thank my committee members Franziska Peterson and Asli Sezen-Barrie, for supporting me through this journey.

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CHAPTER 1

INTRODUCTION

In this chapter, I will present an introduction to this thesis via a description of how I came to be involved in this research, why is the subject of teaching and assessment during the COVID-19 times important, and an overview of the project’s goals and its value.

Motivation

As a current graduate student in a teaching program, I have always been interested in understanding how teaching can be improved, how assessment can be made more effective, how we can increase the learning outcomes for all of our students and last but not the least, how we can increase the satisfaction level of teachers with teaching as a profession. I recognize that all these four interests are highly interconnected. In the beginning of 2020, when the COVID-19 lockdown happened, my original research plans of travel to India to conduct a teaching workshop were canceled. In an inspiring meeting between my advisor and me in Feb that year, I realized that studying how the lockdown was going to affect the teaching and assessment process could help enrich my overall understanding of teaching and assessment.

In science, when we want to understand a system better, we often tweak some aspect of it and see how that changes the system to understand its role in the overall structure. As schools went online suddenly, a lot of the usual unalterable parameters got altered. Many fundamental choices and assumptions about teaching and learning were suddenly called into question, either by circumstances, by the systems in which teachers worked, or by teachers themselves. Students were no longer bound by the walls of the classroom and teachers did not have access to a real whiteboard or lab supplies. For most schools classes were asynchronous and there was no scheduled time for students to do their work. There were no collaborations (or distractions) among students. The role of the home environment and parents became more important than ever before. Everything changed.
Thus, being able to understand the experience of teachers who were teaching during these times will help us better understand how things play out in the classroom, in general. This thesis is an investigation of how teachers responded, across many different aspects of teaching and assessment.

**Why Assessment?**

According to Avargil et al. (2012), a teacher’s assessment knowledge (AK) is the highest stage in the teacher’s professional growth, which builds on his or her Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK). Thus, the exploration of the domain of assessment can be used as one representation of an instructor’s thinking and expertise about classroom education. Nevertheless, one must be clear that even though the presence of a good assessment design and plan suggests a teacher’s expertise, absence of one does not mean the absence of expertise.

Moreover, given that COVID-19 changed our teaching environment drastically and suddenly, studying assessment practices during the lockdown time could help highlight many facets of teachers’ assessment knowledge.

Thus, this study focused on the experiences of Maine secondary science teachers with their process of assessment, and how their assessment practices and goals changed during COVID-19. By focusing on assessment, the initial round of analysis uncovered that teachers spoke (in the interviews) more about their teaching approaches, methods, and techniques to overcome remote learning challenges, than just assessment practices. Not only does this emphasize how connected all these different practices are in science teaching and learning, but it is also consistent with research that shows that teaching and assessment are highly linked, and it is hard to talk about one without the other (James, 2006).

Another reason to focus on assessment practices was the fact that assessment is directly linked to student learning outcomes. The COVID-19 lockdown had a big impact on student learning, and one thing that changed for many teachers was their year-end objectives or the student learning outcomes they had for their students. As will be shown in this study, most participating teachers prioritized contact, health & safety, and well-being of their students over content learning, at least for some amount of time at the
beginning of the pandemic. All these shifts affected the assessment process explicitly or implicitly. Thus, the shift in student learning outcome affected assessment.

The initial round of analysis showed that it is important to consider what happened to instruction in the process as well. If the end goals change (student learning outcomes), the means to reach them change as well (instruction), and thus, the way to measure these goals (assessment).

**Purpose and Goal of this Research**

The COVID-19 epidemic led to profound changes in society and in our educational systems, giving us an opportunity to observe the educational system when it is put under great stress. The observations made of teachers at this time can have a broader impact than thinking only of the early stages of the COVID-19 epidemic. These results can also serve to understand more broadly how teachers might engage in teaching and assessment when the system of teaching is put under great stress. The COVID-19 epidemic was, from this perspective, an example of such a stress.

The goal of this qualitative research study is to understand how a sample of Maine secondary science teachers experienced the process of teaching and assessment during the COVID-19 lockdown as schools went remote. Ten secondary science teachers from schools with different socioeconomic status (SES) completed semi-structured interviews, and the following five research questions guided this study:

1. According to the secondary science teachers, how were their students impacted by the COVID-19 lockdown? In what ways did teachers ensure fairness and equity for all their students?
2. How did the priority and expectations of teachers shift after going remote?
3. How did their assessment methods and teaching practices shift after going remote? What challenges did these secondary science teachers face with teaching and assessment?
4. What other factors outside of the classroom (parents, administration, and personal) affected their teaching during remote learning?
5. What lessons were learned through remote teaching and what is the vision for the future?
These questions help us to understand sequentially how the lockdown affected teaching. Before talking about anything else, it is important to understand how the students were impacted with all this, according to the teachers (research question 1). As the assumptions and decisions that a teacher makes about his teaching and assessment process is often based on the students and their condition. In addition, given the variation in impacts on different students, the inherent inequities in the classroom increased. Thus, the connecting question tries to understand how teachers tried to be fair and equitable, given the variation of impact on their students.

Next, our goal was to identify new priorities of teachers after moving to remote learning, and how their expectations for student learning outcomes shifted. This helps us to understand all the changes that happened in their assessment methods and teaching practices, and any challenges associated with it. The fourth research question focuses on what teachers personally went through, and how supported they felt from admin and parents at their school. The last research question targets successful teaching practices during remote learning, and how teachers plan to use what they learned for their future teaching plans.

Besides investigating the experience of teaching during the COVID-19 lockdown of all teachers in our study through these five research questions, we are also interested in seeing how these experiences varied across schools with different SES.

Apart from answering the five research questions through five themes (see chapter 4), this study also discovered some other interesting findings through an open coding approach (guided by grounded theory coding technique, see chapter 3).

Alissa, one of the participants in this study, mentioned “what we can learn from a difficult situation is a wonderful spin on a difficult situation, so this research is extremely valuable.”

This research adds value to multiple areas such as teaching, assessment, curriculum, professional development, and policy. It helps us to understand and describe how our students were affected during the
COVID-19 lockdown based on the data gathered from teachers, and how this impact was different for students based on the SES of the school. It helps us to understand the unique challenges that secondary science teachers faced during remote learning, and how these challenges varied across schools with different SES. Moreover, how did these challenges affect teaching practices and assessment methods in these different schools? In addition, it adds to our knowledge of how different teachers used various strategies to deal with these challenges of remote learning, what worked for them, and what they learned from it.

Apart from the five overall themes, the additional seven emergent findings, which came out by examining certain elements of the five themes, inform us on different subjects. It educates us on how to provide additional support to students at high-need schools. It informs curriculum developers to make assessment design for crosscutting concepts more accessible to teachers. In addition, it informs policymakers about the merit and demerit of different grading systems that were adopted during remote learning in Maine. Next, it informs how many facets of the differentiation of instruction were impacted, and what kinds of differentiation still happened. Afterwards, we learn how the impact on all students was not the same, with two special cases, first of some struggling learners who unexpectedly did well, and second, for students with special needs whose condition worsened during the lockdown teaching. Lastly, it also informs us of the unique challenges that middle school teachers faced during remote instruction.

In conclusion, this study has great value and it educates us on multiple fronts about our current education system in Maine, based on detailed examining of the interview data collected from the ten teachers, and how to improve it. This work can then serve as an example of how teachers reacted to an upheaval in the education system, which might inform us in the future, should a similar event happen again. Next, we will see some literature that is relevant to this study.
CHAPTER 2

THEORETICAL FRAMEWORKS AND LITERATURE REVIEW

In this chapter, I introduce the learning theories and frameworks that were relevant to this study. These bodies of knowledge are used to make sense of the data that was collected through the interviews with the ten teachers in this research. These theoretical accounts will be used for referencing while discussing our findings about teaching and assessment during the COVID-19 and how teachers had a shift in their priorities, expectations, assessment and teaching approach, and while talking about their challenges and what worked for them while teaching in Spring 2020 after going remote due to the lockdown.

Literature in this chapter will help us understand students' needs in an online classroom via Maslow’s hierarchy of needs, teachers expectations, various terminologies related to teaching, assessment types & methods, the assessment triangle, and NGSS three-dimensional assessment.

Students Needs in the Online Classroom through Maslow’s Hierarchy of Needs

In 1943, Maslow proposed a motivational theory in psychology, comprising a five-tier model of human needs (see Figure 1). This theory has been adopted in many disciplines, including education. Education researchers have tried to use this framework to understand and explain the hierarchy of needs that students have inside a classroom. Researchers continue to discuss and use Maslow’s hierarchy of needs triangle as a framework, such as to examine and understand how students' various needs can be addressed in online courses (Milheim, 2012). The different levels of needs on Maslow’s hierarchy and their educational equivalent when teaching online classes, as discussed by Milheim, are introduced below.

(i) Physiological Needs: These consist of need for food, air, water, and warmth. They are the most essential needs to survive for a human being. Similarly, in remote instruction, apart from basic needs like food and water, essential tools like books and materials, computer, access to high-bandwidth internet,
familiarity with online learning management tools such as Google Meets, Zoom, Google Classroom, etc., and a study space, are the essential requirements for students to even participate in online learning. Lynch (Lynch, 2001) recommends that these items be covered in a pre-course orientation. However, given the unexpected and sudden nature of the transition to remote learning during COVID-19 pandemic, such orientation was not possible.

(ii) Safety Needs: When physiological needs are met and are no longer controlling thoughts and behaviors, the next step in Maslow’s hierarchy is the need for security. In the original model (Maslow, 1943), safety referred to shelter, including a sense of familiarity and comfort. According to Maslow, without safety, people feel anxious and uncertain. In the classroom, this familiarity and predictability is provided by routine and structure for students. Studies have shown that it takes some time for students and teachers to adjust to the virtual classroom setting if there was no prior experience (Conrad, 2002; Kenny, 2002). Consistent course format and interface, and communicating clear learning objectives and grading expectations are important for students to feel safe and cared for in the online learning environment (Milheim, 2012).

(iii) Needs for love, affection, and belongingness: When the needs for safety and for physiological well-being are satisfied, the next class of need for relationships arises. Maslow states that people seek to overcome feelings of loneliness and alienation by a sense of belonging, and being accepted by others. In an online course, it is important for students to have interactional time with the instructor and their peers to develop a sense of community. These interactions can be face-to-face or through an indirect medium such as a discussion board. Moreover, customized individual constructive feedback from the instructor and healthy collaboration with peers can help students feel accepted as a part of the learning community.
(iv) **Esteem Needs:** When the first three classes of needs—physiological, safety, and relationships—are satisfied, the needs for esteem can become dominant. It involves needs for both self-esteem and for the esteem a person gets from respect of others. Self-esteem and a sense of value cannot be attained in the absence of a strong community of learning and collaboration (Curtis & Lawson, 2001). Responsive feedback, an inclusive environment, and appropriate course preparation are important for esteem (Milheim, 2012). Research also shows that students who lack familiarity with an online course setting may feel lower sense of self-esteem and self-efficacy/confidence in the course environment (Lynch, 2001).

(v) **Needs for self-actualization:** When all of the aforementioned needs are satisfied then are the needs for self-actualization activated. This fifth level of need for self-actualization is described as an “urge to grow, the pressure to self-actualize, the quest for one’s identity” (Maslow, 1987). In education, this can be seen as intrinsic learning, a learning motivated by inherent interests. Intrinsic learning is the ultimate goal of all education (Maslow, 1965). In online learning, for students to achieve this state of self-actualization, the role of the instructor should be to assist the student to manage their own learning (Levitch & Milheim, 2003) Instructors should adopt a more facilitative (Tisdell & Taylor, 1999) and humanist approach (Kanuka, 2008) and focus on self-directed learning.
It is important to note that some researchers have criticized the strict hierarchical nature of these needs (Fallatah & Syed, 2018) and Maslow himself admitted that people can be motivated by needs on multiple levels at the same time (Maslow, 1987). Nevertheless, for our purpose, the focus is on the existence of these various needs and not necessarily on how hierarchical they are.

As will be shown later in this study, as students went into online instruction mode at the beginning of the pandemic, they had a variety of needs that can be described by Maslow’s framework and Milheim’s online learning analogous to Maslow's needs. Their most basic needs were food (especially the ones on free or reduced lunch at school), shelter, and health concerns due to the Coronavirus. Moreover, basic study materials and access to technology were important from an educational standpoint. Students needed time to adjust to the new and unfamiliar online environment and platforms (like Zoom and Google Classroom), and to feel safe and cared for. In addition, they needed routine, structure, and consistency in course structure, format, and design. Finally, students needed a chance to engage, collaborate, receive feedback and a chance to self-direct their own learning. Table 1 below summarizes the discussion.

Table 1. Maslow’s Five Levels & Pedagogical Needs: *A simplified version of five levels of Maslow’s model and respective pedagogical prescriptions for online learning* (Milheim, 2012).

<table>
<thead>
<tr>
<th><strong>Maslow’s Five Levels</strong></th>
<th><strong>Major Tenets</strong></th>
<th><strong>Pedagogical Prescription for Online Learning</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 5: Self-actualization</strong></td>
<td>Achieving potential</td>
<td>Self-directed learning&lt;br&gt;Learner guided&lt;br&gt;Assistive tools to foster sense of self</td>
</tr>
<tr>
<td><strong>Level 4: Self-esteem</strong></td>
<td>Respect from self and others</td>
<td>Responsive Feedback&lt;br&gt;Inclusive climate&lt;br&gt;Course preparation</td>
</tr>
<tr>
<td><strong>Level 3: Relationships</strong></td>
<td>Belongingness</td>
<td>Collaboration&lt;br&gt;Community of learning&lt;br&gt;Personalized feedback</td>
</tr>
<tr>
<td><strong>Level 2: Safety</strong></td>
<td>Comfort, familiar, certain</td>
<td>Consistent course format and design&lt;br&gt;Clear requirements&lt;br&gt;Pre-course preparation</td>
</tr>
<tr>
<td><strong>Level 1: Physiological</strong></td>
<td>Food, shelter, and (in this study) COVID-19 related Health and Safety concerns</td>
<td>Books and materials&lt;br&gt;Softwares/Learning management tools&lt;br&gt;Computer access&lt;br&gt;High-bandwidth internet&lt;br&gt;Safe study environment</td>
</tr>
</tbody>
</table>
Teacher Expectations

Teacher expectations and how they influence student learning outcomes have been extensively studied by researchers for more than 50 years. Education research shows that students can change (for better or worse) as a result of how their teachers see them. In this study, teacher expectations are defined as inferred judgements that teachers base on their knowledge of students about “if, when, and what” students can achieve at school (Good, 1987; Rubie-Davies, 2014).

The Excellent Teacher Thinking Model (Hamzah et al., 2018) suggests that out of all the five components—teaching philosophy, Pedagogical Content Knowledge (PCK), teacher expectations, management style, and teaching objective—of an excellent teacher’s thinking model, teachers expectation is the most important.

Scientific study of teacher expectation became nationally recognized with the famous “Pygmalion in the Classroom” article of 1968, where two researchers showed that biased expectations of teachers could affect reality and create self-fulfilling prophecies (Rosenthal & Jacobson, 1968) for student performance. In this study, teachers in a California elementary school were told that some of their students (about 20% chosen at random) could be expected to be “intellectual bloomers” that year, doing better than expected from their classmates after a disguised IQ test. Later, it was seen that these randomly chosen students actually had significant gain compared to their peers. This is also called the observer-expectancy effect. This created a big topic of research about how teacher expectations can affect student learning outcomes.

This study was both supported and criticized by many researchers and attempts were made to reproduce the effect. The current knowledge indicates that teachers' expectations can significantly affect students’ learning outcomes but the effect is not consistent across contexts or students. It depends on students' backgrounds, a teacher’s level of differentiation, and an array of other setting related factors.

A simplified four-step version of the “expectation effect process” model (Brophy & Good, 1970) which shows how teacher’s expectations affect students' learning outcome is adopted here from a 2018 review paper on teacher expectations (Johnston et al., 2019).
In brief, this model explains how teacher expectations (step 1) leads to improved or limited student outcomes (step 4). Teachers develop expectations of students consciously or subconsciously. Based on these expectations, they treat students differently. Different teachers have different expectations, and they affect their students differently based on students’ background, level of differential treatment from the teacher, and other factors. Students react to these expectations based on culture, context, and other factors. Students are affected in terms of their “self-concept,” “engagement,” and “motivation” (Trusz, 2018), and this leads to either improved or limited student performance.

In our study, teachers’ expectations of students were affected significantly by the COVID-19 pandemic. Moreover, we also investigate how teacher expectations played a role in areas of assessment and teaching during remote learning. However, given the limited nature of the study, the effect on students’ reactions and outcomes was not part of the data as we did not interview students or observe the online classes. So, our interest lies in the first and second step of this four-step teacher expectation model.
Teaching Terminologies

Teaching is defined as the act of imparting or providing knowledge or skills to another. Teaching is governed in part by beliefs and ideas that teachers have about learning and teaching, as well as the environment in which they teach. In this study, teachers talked about their teaching practices in response to multiple questions, using terms like teaching approach, methods, procedures, and teaching strategies. To make sense of their responses and discuss our findings, this study uses the framework provided by Hasanova (Hasanova, 2021), where he explains these terms and highlights the differences. According to the article, following are the meaning of each of these terms:

Teaching Approach: An approach is a way of considering or doing something. In the article, the teaching approach is based on a set of principles, beliefs, or ideas about the nature of learning. It is the overall wisdom, and it sets the general rule or principle to make learning happen. Teaching approaches to learning can be generally categorized into two types:

- **Teacher-centered approach to learning:** Teachers are mainly the authority figure, and students are viewed as “empty vessels” whose primary role is to passively receive information via lecture or direct instruction. The teacher is primarily responsible for passing down the knowledge. Assessment then measures how well students have taken in this knowledge. In this model, teaching and assessment are viewed as two exclusive things.

- **Student-centered approach to learning:** Even though teachers are still an authority figure in this model, students and teachers both play an important role in the learning process. The teacher is primarily a facilitator. Student learning is measured through both formal and informal assessment, including group projects, class participations, etc. Teaching and assessment are connected, and student learning is continuously measured during instruction. Small group discussions, simulations, projects, etc. are some examples of child-centered methods.

Teaching Methods: Teaching methods are defined as well-organized, orderly, systematic, and well-planned procedures. These are dependent on the teacher's educational philosophy, classroom
demographics, subject area, and school mission. It considers the ability, needs, and interests of the learner, and guides students and teachers in undertaking different classroom activities and lessons.

**Teaching Strategy:** A strategy is a careful plan for achieving goals, usually over a long period of time. In the same spirit, the article from Hasanova defines teaching strategy as a careful plan of teaching activities which ensures effective teaching and learning. It is a plan of action to accomplish a specific goal.

**Teaching Techniques:** This is more personal to a teacher. It is an individual teacher’s unique way to apply a strategy to carry out a particular task, in the teaching and learning process.

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Figure 3. Teaching Terminologies: A figure from Havanova paper that shows how teaching approach, method, strategy, and techniques are basically a subset of each other (going from universal set, i.e. approach, to smallest subset-technique) (Hasanova, 2021).

Thus, all of these words are highly interconnected. Based on the basis of approach, one’s teaching methods are defined, which in turns determines the strategy and techniques. In this study, the differences between these terms will play a role in the analysis of how teachers responded to changes in their teaching activities due to the pandemic.
Assessment Types and Methods

Assessment can be defined as a process of gathering evidence to understand or evaluate a student’s learning to provide feedback to both the instructor and the learner to improve teaching practice and learning strategies respectively. This learning could be either in content skills or in other forms such as change in attitude, interests, beliefs, values, motivation, self-regulation strategies, and self-efficacy (Schunk, 1989). Assessment can be in the form of a measurement or simply inferences. However, it is always indirect (as we have no way of directly looking inside the learner’s brain), and is often based on standards (required for any measurement) and underlying assumptions.

Types of Assessment: There are many types of assessment depending on the purpose such as formative assessment, interim assessment, summative assessment, diagnostic assessment, curriculum-embedded assessment, universal screening assessment, and progressive monitoring assessment. However, in this study, we will restrict our focus to the formative and the summative assessments.

Formative assessment: According to the Formative Assessment for Students and Teachers (FAST) and State Collaboration on Assessment and Student Standards (SCASS) (SCASS, 2012) “Formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students’ achievement of intended instructional outcomes.” To better discuss the findings in later chapters, we will split formative assessment into two parts, formal formative assessment and informal formative assessment. This division is inspired by the article “A Model of Formative Assessment in Science Education (Cowie & Bell, 1999).

- Formal formative assessment would include non-graded tests, quizzes, assignments, etc. These are usually done with the whole class.
- Informal formative assessments would be the casual data that teachers collect while being in the classroom and reading both verbal and non-verbal cues (such as facial expressions, hand gesture,
and body posture) in the classroom. This is usually carried out with individual students or small groups.

**Summative assessment:** This is defined as designed to provide information regarding the level of student, school, or program success at an end point in time (SCASS, 2012). The purpose for the same could be the following: reach an evaluation about the effectiveness of a program, arrive at an inference about a student’s mastery of the curricular aims, arrive at a grade, and meet local, state, and federal accountability requirements. The most common purpose of summative assessment is testing.

Formative assessment has recently gained more attention than summative assessment. It has also shifted from an attempt to elicit the right response from the students to engaging with what students know to improve teaching (Coffey et al., 2011). One element of this study was to understand how the common formative assessment practices of teachers changed in remote learning compared to the traditional classroom settings.

**Assessment Methods:** As there are different types of assessment, there are also different methods of doing these assessments. Some of the methods include direct observation, written responses, oral responses, rating by others, self-reporting using questionnaires, interviews, stimulated recalls, think-aloud, and dialogues (Schunk, 1989). The method of assessment is typically chosen based on situation and context.

**The Assessment Triangle**

In chapter 2 of the book *Knowing What Your Students Know* (NRC, 2001), three main purposes of assessment are outlined: assessment to assist learning, assessment of individual achievements, and assessment to evaluate programs. For the purpose of our study, the focus is on assessment to assist learning. According to the book, “effective teachers use various forms of assessment to inform day-to-day and month-to-month decisions about the next steps for instruction, to give students feedback about their
progress, and to motivate students.” This kind of assessment can include both formal methods like quizzes, etc. and informal methods of assessment such as classroom projects, feedback from automated assessments, observation, homework, conversations with and among students, all interpreted by the teacher in light of additional information about the students, the schooling context, and the content at hand. These types of assessments, both formal and informal, are also called formative assessments, as discussed in the above section (types of assessment).

It is important to note that all assessments, at best, are close estimates, and they don’t offer a direct pipeline into a student’s mind (NRC, 2001). The assessment triangle framework that this study has used from the NRC report rests on the idea of reasoning from evidence (Mislevy, 1996). In reasoning from an evidence model, one collects data, which on itself is meaningless, but when analyzed under some interpretational framework, becomes evidence. This process of reasoning from evidence can be represented through a triad: the assessment triangle.

![Assessment Triangle](image)

Figure 4. The Assessment Triangle: This figure shows the interactive nature of the three pillars of the assessment design and is adapted from the NRC report (NRC, 2001).

According to the authors, the corners of the triangles represent the three key components of any assessment: a model of student cognition and learning in the domain, a set of beliefs about the kind of observations that will provide evidence of students’ competencies, and an interpretation process for making sense of the evidence. Much like in a triangle, each corner interacts and depends on the other two.
A major finding of the NRC report was that for an assessment to be effective, the three elements must be in synchrony. Below is a summary of each of these three elements.

**Cognition:** This refers to a belief or theory about how students learn and represent knowledge and skills in a given domain, such as physics. For a classroom assessment to be effective, teachers need to start with explicit and clear conceptualized cognitive models of learning that they are trying to develop among students. These models should be informed from educational research and how people learn, as well as experience of expert teachers.

**Observation:** Assessments are also based on beliefs about what kinds of tasks, activities, or situations elicit students in the ‘right’ way to say, do, or create something that shows their knowledge and skills. Thus, the tasks chosen for students to respond to are important, and must be carefully designed. In addition, it is also critical that the performance task be directly and explicitly aligned to the cognitive model represented in the learning outcomes.

**Interpretation:** Student data collected via observations is then analyzed via certain assumptions and models for inference. This side of the triangle includes all the methods and tools used to reason from evidence (observations). It shows how the observations obtained from a set of tasks constitutes evidence for the knowledge and skills (cognitive model) being assessed.

These three elements of the triangle not only make sense on their own but also connect to each of the other two elements in a meaningful way. Cognitive models provide clues about types of situations (tasks) that will elicit evidence about these models and vice-versa. A cognitive theory of how people develop competencies also informs the inference framework to transfer student data into assessment evidence. Lastly, knowing the various interpretation models helps in designing a set of observations that are effective and efficient. Thus, these three vertices of the triangle must work together in synchrony for any assessment design to be successful.
NGSS three-dimensional Assessment

The new K-12 framework (NRC, 2012) and adoption of the Next Generation Science Standards (NGSS) (NGSS Lead States, 2013) have further pushed the meaning of the dimensions of science learning. In 2013, NGSS marked the beginning of a new way to teach science in the classroom. Instead of being content driven, the standards emphasized on developing skills. It did so by proposing a three-dimensional teaching of science: Disciplinary Core Ideas (DCI), Crosscutting Concepts (CCCSs), and Science & Engineering Practices (SEPs). The State of Maine adopted NGSS in April, 2019.

Now, with the multi-dimensional shift in teaching, the assessment is also expected to be three-dimensional. In fact, only a well-developed three-dimensional assessment system can reinforce a three-dimensional teaching. But, how one assesses the three-dimensional science learning, especially the grasp of SEPs and CCCSs is the pressing concern (Penuel & Reiser, 2018). Some researchers have taken the initiative to develop a three-dimensional assessment protocol (Laverty et al., 2016). While educators are making efforts to depart from traditional content-based assessments to incorporate three-dimensional assessment designs, there are some challenges, particularly with crosscutting concepts. Some research has described the non-intuitive nature of CCCs and proposed ways to use it that have the potential to make the classroom more equitable (Cooper, 2020).

Findings in this study have discussed how teachers assessed the three-dimensional learning of their students during remote learning.
CHAPTER 3

METHODODOLOGY

Research Approach and Methods

The qualitative research in this thesis is foundationally informed by the phenomenological approach. Excerpts from teachers were coded, categorized, and analyzed for all interview questions, and five themes emerged from this analysis. Comparing answers from the ten teachers further informed an enriched understanding of the phenomenon of teaching and assessment during the initial phase of COVID-19 lockdown, highlighting the differences between schools based on SES. Apart from the phenomenological approach, an open coding approach, inspired by grounded theory, was also utilized to find additional seven emergent findings. In this section, I describe these methods as well as the research setting, process, and methods of analysis.

A phenomenological study describes the common meaning of lived experiences of a concept or phenomenon, for several individuals. This study focuses on describing what participants have in common as they experience the phenomenon of interest (Creswell, 2016). In this approach, a phenomenon is described as an “object” of human experience (Van Manen, 1990, p.177). The researcher is interested in describing “what” they experienced and “how” they experienced it (Moustakas, 1994). This approach takes the empiricist lens to view things as they are and structure the experience in a way that one can see the most essential aspects of what has happened. In the 20th century, Edmund Husserl presented this idea for the first time (Husserl, 1931). The main goal of phenomenological research is revealing meaning.

According to Creswell (2016) the heterogeneous group size under study can vary from 3 to 4 individuals to 10 to 15, the researcher separates (brackets) themselves out by discussing personal experiences with the phenomenon, data is collected typically through interviews, and data analysis involves going from narrow unit of analysis (significant statements) to broad units (meaning units) to
describe the essence of the individuals lived experiences. The researcher develops a textual description of the experience of the persons (what was experienced), a structural description of the experiences (how they observed it in terms of the conditions, situations, and context), and a combination of two to convey a general essence of the experience.

There are two approaches to phenomenology. First is the transcendental phenomenological approach (Moustakas, 1994) in which the focus is on description of the phenomenon, and second is the hermeneutic approach (Van Manen, 2016) in which the focus is on interpretation of the description/meaning of the lived experiences. Both approaches inform our study of teachers' lived experience through the process of teaching and assessment during the COVID-19 lockdown as we describe “what” they experience, and wherever possible an explanation of “how.”

In the process, a phenomenological study starts with a description of the lived experience. Then one tries to give a structure to these lived experiences by describing all the parts and how they fit in. Afterward, interpretation and explanation follow, gradually increasing abstraction.

To better understand and explore the phenomenon, comparative coding process was utilized. The answers from all ten secondary science teachers were compared with each other, and commonality among teachers belonging to schools with similar SES (for example high-need schools), and differences among schools with different SES (for example, high-need vs affluent schools) were discovered.

As we see below, our participants were purposefully selected from schools that were either affluent, high-need, or somewhere in between (called middle-level), to have a rich understanding of the process of teaching and assessment across teachers who teach students with different socio-economic backgrounds.

**Open Coding:** Another qualitative research method of open coding, inspired by the grounded theory approach, was used to look at the data collected in this study. This method led to some unexpected
emergent findings in addition to the five overall themes. In fact, these seven emergent findings highlighted some nuanced parts of the five overall themes.

It is important to note that even though the method of analysis was guided by a grounded theory approach, the purpose was not to develop a theory (as is in grounded theory approach) (Creswell, 2016). The prior five themes and research informed the open coding process, and the emergent findings that came out of it further enriched our understanding of the phenomenon by highlighting its nuances.

Setting

Description of Subjects: The participants in this study were 10 secondary science teachers (6 male, and 4 female) from all over the state of Maine. 8 of them were high school teachers, and 2 were middle school teachers. Teachers were recruited on a volunteer basis (thus, not paid) using a snowball sampling method, which means participants were asked at the end of the interview if they could refer another teacher to us. However, it is important to note that we were interested in recruiting teachers from different types of schools based on the socioeconomic status of the student population, and the same was conveyed to the participants while requesting for referrals. So, it was random in the sense of who was recruited but biased in the sense that we were interested in representing the voices of teachers from different kinds of schools in Maine to give an essence of the lived experience of science teachers while teaching during the lockdown period.

The first few teachers were requested by referrals made from the Research in STEM Educations (RiSE) department faculty at the University of Maine. All teachers who took part in the study gave verbal consent to participate through a script (Appendix C) that was read out loud at the beginning of the Zoom interview. Moreover, teachers were given an electronic copy of the consent document via email (Appendix D).
Description of Schools: We recruited 10 teachers from three different types of schools: affluent (2 private, 1 public), middle-level (3 public), and high-need (4 public) schools. The classification of these 10 schools was done on the basis of the student population that was on free or reduced lunch. According to the Maine Department of Education, 38% of students qualify for free or reduced lunch (FRL). All three schools whose schools had less than 25% FRL were categorized as affluent. Those above 25% but below 50% FRL (i.e. close to the state average of 38%) were classified as middle-level, and anything above 50% FRL was considered high-need. It is worth noting that two of the affluent schools are private and don’t have any children on free and reduced lunch (as reported by the teachers themselves). The data for their student population on free and reduced lunch was collected from Press Herald website (Maine School Database, 2014).

To make referencing simple when discussing the case of any teacher, their alias name appears with the first alphabet of the category name (i.e. A for affluent, M for middle-level, and H for high-need). Thus, Amy, Adam, and Alissa are all affluent school teachers; Mike, Mia, and Myra are middle-level school teachers, and Henry, Hank, Hazel, and Hope are all high-need school teachers. Also, Myra and Hope are two middle school teachers, and everyone else is a high school teacher. Real names and identity information do not appear in this work for reasons of confidentiality.

Process

Interviews: Data was collected through interviews that were expected to be an hour long, and in reality, lasted from 40 mins to 2 hours. The interview was conducted via Zoom and recorded. The nature of these interviews was semi-structured and conversational (Newcomer et al., 2015). A structured interview was avoided to allow for a rich and in-depth conversation about teachers' lived experiences of teaching and assessing during the pandemic. The purpose of the interviews was to develop a qualitative understanding of the experiences of teachers (Mann, 2011). A set of 13 open-ended questions were piloted in advance (Dörnyei, 2007). The same set of 13 questions was asked of all teachers (and shown up on a slide show), however, the follow-up questions that might have come up based on what teachers
talked about were different for different teachers. Interview questionnaire was designed to understand priorities and expectations, assessment, different assessment types, teaching practices, challenges faced by teachers, impacts on students, equity, what worked, and what did teachers learn from the experience (see Appendix C for the interview script).

Most teachers reported in the last question (Q.13), when asked “was there anything else that you wish I had asked that I didn’t,” that they were very satisfied and felt their story was explained well with the 12 questions.

**Timeline:** It is also important to highlight the duration of this study. March 2020 is when the lockdown for schools in Maine had happened. In April, the committee and this project was finalized. In June, the approval for the study by the Institutional Review Board (IRB) was received. Over the months of June, July, and August, 2020, the 10 interviews took place. All teachers had just finished their first experience of teaching remotely. Afterwards, for the next two years, the gathered data was transcribed and analyzed, and the writing was done.

![Figure 5. The process flow of this study.](image-url)
Analysis

Once the interviews were recorded, the researcher watched each of the recordings slowly, pausing wherever needed, and making personal notes. This was done to get an overall idea of the big picture and inform the coding process.

Next, the recordings were uploaded and transcribed using the Otter.ai software, and two rounds of manual editing was done for each interview transcript to reach precision and reduce grammatical and syntax error (Liang & Fu, 2016). Next, once the transcripts were ready they were uploaded on the Atlas.ti coding software and the first round of coding was done through this to see the general patterns and big themes (Hwang, 2000). Afterwards, three more rounds of manual codings were done that revealed all 5 overall themes and 7 emergent findings. The process of highlighting was used to code (Goodwin, 2015).

Initially, each of the 13 questions were coded as a theme in itself and whatever was relevant to the question, no matter where in the interview it appeared, was coded for that question/theme. However, excerpts that were relevant for some questions appeared frequently in other questions and vise-versa. For example, when talking about assessment methods (in Q3.), teachers frequently mentioned formative assessment, and while talking about formative assessment (in Q6.) later in the interview, they made some comments about their assessment methods, in general. Therefore, some questions naturally got clustered together, leading to 5 emerging themes rather than 13 independent themes for 13 questions asked during the interview.

In a given theme, that can include more than one question (for example Theme 1 involves Q7. & Q8.), the answers for all questions were coded and analyzed together. Some independent emergent findings that appeared during the interviews that needed special attention are discussed separately at the end of chapter 4.

During the analysis process, different excerpt(s) that were deemed as important statements were assigned codes that included a phrase to catch the essence of that excerpt. For example, during question 1 (what were your priorities), Hank said, “Our priorities were contact and keeping the kids, keeping in
contact with the students. In fact, we spent a lot of time, you know, I spent more time emailing, calling
parents, just checking on kids to make sure they were, you know, that everybody was getting what they
needed. I spent more time doing that than I think I did, you know, looking at the school work that kids
did.” This whole excerpt was coded as “Contact and being available”. Sometimes, one excerpt could also
have multiple codes to it. For instance, in the same question, Mike, a middle-
level school teacher,
answered, “My no. 1 priority was to create a routine and get them engaged in the routine” was coded for
both “Routine was a priority” code and “Keeping students engaged” (see Table 6).

The words used in the phrase codes may or may not have appeared in the answer explicitly. Then
these different phrases were counted for frequency. It is worth mentioning that one phrase, used as a code,
could have multiple examples from a single teacher. It was not important how many times it appeared, but
whether it appeared at all or not. For example, again for Q1. (talking about priorities) Mike added, “I
mean, there were so many, it was crazy. I mean, the number two priority was to get everybody
involved...” based on the knowledge from his previous statement (in the above paragraph), this statement
was also coded for the phrase/code “Keeping students engaged.” No inter-rater reliability measurements
were taken at the time of coding.

Once the two-three cycles of coding were done, all the codes were arranged in a column, and the
list of teachers were arranged in the top row, and the frequency for each code was counted (see Table 9,
for example). Minor codes that were only said by one or two teachers, and did not help explain the overall
meaning of the theme were discarded.

One important note here is that the order of the themes is not the same as the order of the
questions. After the complete analysis of all five major themes, it was decided that it makes more
sequential sense to start with what the impact on students was (Q7.) and how teachers were trying to be
fair and equitable, given the impact on their students (Q8.), and thus, these two questions were clustered
and labeled as Theme 1. Then, Theme 2, which talks about the priorities and expectations of teachers as
they went into remote instruction, was discussed. Afterwards, the heart of this thesis, how teachers went through the process of teaching and assessment, and what challenges they encountered, was detailed in Theme 3. There were many challenges and concerns, some of them were not classroom related directly such as parents and admin, we described them in Theme 4. Last, but not the least, what teachers learned from this 4 month of lockdown teaching and what visions and strategies they held for the future is discussed in Theme 5: lessons learned and vision for the future.

**Theme 1: Impact on Students and Equity Issues**

(Q7.) How were your STUDENTS IMPACTED due to this shift to remote instruction, in terms of emotional stability, technology access, study environment, family issues, lack of routine, boredom, job security, learning style, etc.?

(Q8.) Were you able to be FAIR & EQUITABLE in your assessments, given the variation in impact on different students, and if so, how did you do that?

**Theme 2: Priorities and Expectations**

(Q1.) What were your PRIORITIES for your students after shifting to remote instruction during the COVID-19 pandemic?

(Q2.) Before we moved to remote instruction, what were your EXPECTATIONS about STUDENT LEARNING OUTCOMES? How, if at all, did these shifts after moving to remote instruction?
**Theme 3: Teaching and Assessment with Challenges**

(Q3.) How, if at all, did your ASSESSMENT METHOD shift following the move to remote instruction? How, if at all, did your ASSESSMENT CRITERIA shift following the move to remote instruction? What were the reasons for any shifts that happened?

(Q4.) To be more specific, what challenges, if any, did you face in assessing students in the context of the three NGSS dimensions:

   (i) Core Content (ii) Cross-cutting concepts (iii) Science and Engineering Practices

(Q5.) How did these changes in assessment influence your TEACHING PRACTICES?

(Q6.) How have you used FORMATIVE ASSESSMENT to observe your students’ learning during this time of remote instruction? Did the change in platform or methods (for example, Zoom, Google classroom, etc.) influence the feedback process?

**Theme 4: Factors outside of Classroom**

(Q9.) What were some other CHALLENGES (in terms of parents, administration or personal) in assessment that you faced as an instructor?

**Theme 5: Lessons Learned and Vision for Future!**

(Q10.) What were some SUCCESSFUL STRATEGIES that helped you to overcome personal and professional challenges with assessment?

(Q11.) What do you think you have learned from these experiences that might play a role in your design of FUTURE assessments?

(Q12.) What have been some POSITIVE(S) experiences during this whole experience?
(Q13.) Is there something that you wish I had asked, that I didn’t? Do you have anything else that you’d like to add to complete your story about the process of assessment during the shift to remote instruction?

Teachers’ answers to question 13 could easily fit in the above-mentioned themes, so a new theme was not needed, and it has not been included explicitly in any of the themes as it was an open-ended question.

The analysis approach used was to see what the broad overall patterns were, to describe the essence of the phenomenon of teaching and assessing during the COVID-19 remote instruction for all teachers. Afterwards, responses were sorted according to the type of school, and then any category-wise characteristic differences between affluent, middle-level, and high-need schools were examined through a comparative coding analysis method to further inform the understanding of the phenomenon. Thus, an approach of similarity between all schools to describe the common experience, and comparisons of different types of school (mostly between affluent and high-need) wherever significant was done.

Some topics in the five overall themes were deemed significant beyond just explaining the themes. They were examined further and another round of open coding and analysis was done to find anything significant to these topics throughout the transcripts. As discussed above, grounded theory guided this method. These topics developed into our emergent findings that are discussed at the end of Chapter 4.
CHAPTER 4
ANALYSIS & MAJOR FINDINGS

This chapter has been distributed into five different sections to discuss all the major findings from this study that appear in five overall themes: impact on students and equity issues (Theme 1); priorities and expectations (Theme 2); teaching and assessment with challenges (Theme 3); other challenges related to factors outside of the classroom (Theme 4); and lessons learned and vision for the future (Theme 5). Afterwards, the emergent findings are discussed. It is worth reminding the readers that Amy, Adam, and Alissa are affluent school teachers, Mike, Mia, and Myra are middle-level, whereas Henry, Hank, Hazel, and Hope are high-need school teachers.

Figure 6. Major Findings: *This picture outlines all the major themes and in what order they appear.*

**Theme 1: Impact on Students and Equity Issues**

In March, 2020, the State of Maine mandated an end to in-person schooling due to the COVID-19 pandemic, with obvious impacts on both teachers and students. Across the state, individual districts made different decisions about how to proceed with instruction. These decisions, as well as the impact on students motivated changes in teaching practices and assessment methods that different teachers used in their classrooms. Within this new system of online instruction, teachers taught and assessed in the midst
of all these challenges. In this section, I discuss teachers’ ideas about the impacts of these changes on their students.

IMPACTS ON STUDENTS

Many Decisions that teachers made during this time were driven by the data they were receiving about the condition of their students. One can assume that everyone was impacted due to the March, 2020 lockdown and moving to remote learning. However, was there a difference in impact on student population across different schools i.e. across the three different categories of schools—affluent, middle-level, and high-need? Interview question no.7 asked participants:

Q7. How were your STUDENTS IMPACTED due to this shift to remote instruction, in terms of emotional stability, technology access, study environment, family issues, lack of routine, boredom, job security, learning style, etc.?

Teachers commented on each of these parameters and added more areas of impact to this list. A complete list of different kinds of impacts on students has been provided in the table below. The analysis and coding of this answer for all 10 teachers generated many distinct phrases/codes in the first round. Then, all the codes that had one frequency count (only true for one teacher) were dropped. In addition, any code/phrase with frequency two was also dropped, unless that was shared between 2 teachers in the same category (affluent, middle-level, and high-need). Moreover, the data from our three middle-level teachers, Mike, Mia, and Myra, was also omitted to express the contrast between affluent and high-need schools more clearly. The codes of middle-level schools, as expected, overlapped with both affluent and high need schools for most part. This led to a more simplified table from an enormous spreadsheet.

Thus, the impact was more than presented in the Table 2 below, and the table highlights differences between affluent and high-needs schools. Nevertheless, in the discussion below, I will at times refer to some of the codes from middle-level teachers codes, whenever necessary.
Table 2. Frequency of phrases related to impact on students at affluent and high-need schools.

<table>
<thead>
<tr>
<th>Phrases</th>
<th>Amy</th>
<th>Adam</th>
<th>Alissa</th>
<th>Henry</th>
<th>Hank</th>
<th>Hazel</th>
<th>Hope</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students did not receive differentiated instruction</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>7</td>
</tr>
<tr>
<td>Lack of routine and structure</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>Students were bored</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>Struggle for quiet space</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>5</td>
</tr>
<tr>
<td>No technology issues</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Students missed the social aspect of school</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Parents were invested</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Some students enjoyed being remote</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Lack of motivation</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Received guidance counselor support</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Special-need students needed extra support</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>5</td>
</tr>
<tr>
<td>As time went on, engagement declined</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
<tr>
<td>Students were distracted with phone</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Emotional health highly impacted</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
<tr>
<td>Poor study environment at home</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Some struggling learners blossomed</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Some students were working jobs</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Some students had no internet (rural)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Students with low home support most impacted</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Parents had lost jobs</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
</tbody>
</table>

Codes unique to Affluent schools

Codes unique to high-need schools
Most teachers said that the impact on students was negative in these areas: emotional stability, technology access, study environment, family issues, lack of routine, boredom, job security, and learning style. Four codes were also common to all teachers:

- Student did not receive differentiated instruction
- Being at home, lack of routine and structure impacted them negatively
- Students were bored
- Students struggled to find quiet place to study and work at home

Differentiation of instruction was hard for teachers for different reasons ranging from the silence on Zoom to students just wanting to do the bare minimum. This is discussed deeply in Theme 3. All students were also stuck at home, and the home space and work space were all merged together. In addition, their parents, siblings and other family members were also at home all the time. Moreover, there was a lockdown in the whole town/city so they were stuck and couldn’t go out. Thus, they were bored, and it was hard for them to establish a routine on their own and find a quiet place to study, in the absence of the school structure. As Henry mentioned, “...no one could get them to do anything...because of the lack of routine. They did not do work at home, they never had done work at home...”

Apart from these common impacts on students, there were some significant differences between affluent and high-need schools. As per the teachers, the students at affluent schools had guiding counselor support, and their parents were invested. Where most students struggled with lack of motivation and missed the social aspect of school, some students actually enjoyed being remote. In comparison, the high-needs school students had a huge impact on their emotional health, as mentioned by all of the high-needs teachers. They had a poor learning environment at home, and had stressed parents who had lost jobs. Some students, because of living in rural areas, had no internet connection. Others were supporting their families by taking up jobs. I illustrate these points by highlighting the responses of two teachers, Adam and Hank:
Table 3. Example of differences in impact on students at affluent schools vs high-need.

<table>
<thead>
<tr>
<th>Affluent School Teacher Quotes (Adam)</th>
<th>High-needs School Teacher Quotes (Hank)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“We have a really good counseling</td>
<td>“Like I said, you know, emotional stability...that was our</td>
</tr>
<tr>
<td>department that keeps teachers</td>
<td>number one concern, because so many parents were out of</td>
</tr>
<tr>
<td>informed...we were pretty well</td>
<td>work, kids were stressed.”</td>
</tr>
<tr>
<td>as to students that were not doing</td>
<td></td>
</tr>
<tr>
<td>well”</td>
<td></td>
</tr>
<tr>
<td>“Parents were extremely understanding</td>
<td>“Access to technology we had, we had problems with that,</td>
</tr>
<tr>
<td>as well, for the most part.”</td>
<td>you know...”</td>
</tr>
<tr>
<td>“So I think at the same time, there</td>
<td>“Study environment. It broke my heart a couple of times to</td>
</tr>
<tr>
<td>were certain students who enjoyed the</td>
<td>see kids when they’re all on the screen, you know, and I</td>
</tr>
<tr>
<td>new format, that they enjoyed not</td>
<td>could see some of the home life going on...I remember one</td>
</tr>
<tr>
<td>having to go into school every day.</td>
<td>girl in her bedroom, there’s just a ceiling tile missing,</td>
</tr>
<tr>
<td>But that was the minority, the</td>
<td>you can see the insulation hanging down, and you just go oh</td>
</tr>
<tr>
<td>majority missed the social</td>
<td>my gosh, you know, I felt so bad...I remember one kid, his</td>
</tr>
<tr>
<td>aspect of school.”</td>
<td>mother was always screaming in the background, I had to</td>
</tr>
<tr>
<td></td>
<td>mute him a couple of times. It wasn’t a friendly yell.”</td>
</tr>
<tr>
<td>“Quite a few students reported, just</td>
<td>“I had kids working more hours, some of the kids loved it</td>
</tr>
<tr>
<td>having trouble staying motivated.</td>
<td>because they could work.”</td>
</tr>
<tr>
<td>That was probably one of the biggest</td>
<td>“I found more impact on students who have no support at</td>
</tr>
<tr>
<td>things that students reported in our</td>
<td>home, or very minimal support.”</td>
</tr>
<tr>
<td>final assessment of the class was the</td>
<td></td>
</tr>
<tr>
<td>difficult time staying motivated to</td>
<td></td>
</tr>
<tr>
<td>do the work.”</td>
<td></td>
</tr>
</tbody>
</table>

An unexpected finding of this study is that two high-need teachers (Henry, Hope) and two middle-level teachers (Mike, Myra) mentioned that some of their struggling learners (in traditional classroom) blossomed when teaching went remote. This result will be discussed as a separate minor theme in the next chapter.

It is also worth mentioning that the impact on students with special needs was severe. They needed extra support and more care than usual because of changes in the platform from in-person to online. All the high-need teachers mentioned that the support needed for students with special needs had exacerbated in their schools. Amy was the only affluent teacher who mentioned the same situation, as her school did not have a special-ed department, and the usual instructional support was absent, so the
responsibility fell on her shoulders. Again, this code deserves its own further analysis and discussion (see Chapter 5).

The four teachers, Alissa, Henry, Hazel, and Hope, who said that engagement declined as time went on, had a Do No Harm (DNH) grading system at their school. So, once students who were already passing before the COVID lockdown realized that they could still get the same passing grade without turning in anything, their engagement went significantly down. Teachers reported that the only students who were still engaged at these schools were the ones that were already failing or the ones that realized that they needed the mastery to take an advanced class next year. Most students who already had a pass, their engagement declined, this was perhaps one of the biggest challenges of Do No Harm. This result is also included in a separate discussion about the impact of the grading system on teaching (minor theme, Chapter 5).

In terms of technology, most of the affluent and middle-level schools had either no or some minor issue with technology. High-need schools struggled more relatively to get students access to internet and computing devices. Only one out of four high-need school teachers mentioned that she did not have any struggle with technology.

Some teachers also mentioned that students were very distracted because of having access to their phone all the time and unlike a classroom, teachers could not keep a check on them. Some teachers also suspected that students were playing video games during class time. Hazel said, “If their (students) parents weren’t at home, a lot of times they were gaming or something else and not taking advantage of their time. So, making sure they stuck to a routine was an issue, if they didn’t have parental support…”

It is worth reminding the readers that these impacts discussed above are teachers’ interpretations of the impact on their students. Due to the fact that this study was carried out during the COVID-19 lockdown, no student voices or supporting real-time classroom data could be gathered.
FAIRNESS AND EQUITY

After asking teachers about the impact of lockdown on their students (Q7.), the interviewer asked them whether they (teachers) were able to be fair and equitable to their students? The interview question was the following:

Q8. Were you able to be FAIR & EQUITABLE in your assessments, given the variation in impact on different students, and if so, how did you do that?

The answers received were broad and general, and not necessarily specific to assessment. Three categories identified based on the answers received from the teachers:

1. Yes (Alissa)
2. No (Mia)
3. Yes and No both (Amy, Adam, Mike, Myra, Henry, Hank, Hazel, and Hope)

Even though Alissa said Yes, and Mia said No, most teachers had mixed feelings about it and gave answers that explained how they tried to be fair and equitable, but also what prevented them from being fair and equitable. Sometimes, the teacher explicitly used the phrase that included Yes and No both, for example Henry’s answer to Q8. above was: “Well, Yes, and No. I think that my expectations were low enough, that I tried to make sure that it was equitable in the sense that they (students) didn’t have, that it was not difficult for them to reach the level. And I tried to make sure that all the resources that they might need were available…but I think there were some things that I couldn’t compensate for, for the students that, you know, were living in an environment that didn’t have the resources they needed or had many distractions.”

In general, all teachers tried their best to be fair and equitable, as much as possible, but it wasn’t as good as in a regular classroom. The most common answer among all teachers was that they reduced or adjusted their expectations and they made themselves available for support, to be more fair and equitable. Shown below is a schematic representation of various answers received for this question.
Figure 7. Fairness and Equity: Schematic diagram showing how the ten teachers' answers can be categorized in three codes—YES, NO, YES & NO—with the number in square brackets [ ] showing frequency of the code. It also shows the difference between affluent and high-need schools in terms of how they felt they tried to be fair and equitable (green YES) and when they felt they were not able to be fair and equitable (red NO).

However, even though most teachers mentioned that they tried to be as fair and equitable as possible through different ways, but had situations where they felt they couldn’t be fair or equitable, these ways and situations were different for affluent schools compared to high-need schools.

Affluent school teachers mentioned that they tried to be fair and equitable by adjusting their expectations, being flexible with deadlines for homework/assignments, by giving multiple opportunities to succeed in assignments/quizzes/tests, and by being lenient in grading. Nevertheless, as Alissa mentioned, “some gain was expected of all.”
In comparison, high-need schools significantly reduced their expectations. There was no summative testing at all. Homework assignments were the primary way to teach and assess. If a student attempted assignment and homework in most cases, they were given a Pass. In some cases, only doing half of the school work was enough. The bar was very low, as shown in the example below.

Table 4. Examples of how teachers tried to be fair and equitable in affluent vs high-need schools.

<table>
<thead>
<tr>
<th>Affluent School Teachers’ Quotes</th>
<th>High-Needs School Teachers’ Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“So, I feel like they (assessments) were fair and equitable in that everybody had all the opportunities to get that pass, as many as they needed...Everybody that finished assessments was able to show me that, to at least that 70% mark, that they had learned and could demonstrate some understanding of the concept.” [Alissa]</td>
<td>“We were as fair as we possibly could be...like I mentioned the Corona gift earlier, like they(students) said, some kids got by with minimal minimal work...You know, my bottom line was, if they got half of the assignments done that were presented to them, we gave them a pass.” [Hank]</td>
</tr>
<tr>
<td>“I think I was fair and equitable in that I did not expect the students’ performance to be what it had been. And I adjusted my grading accordingly. I became much more lenient in grading.” [Adam]</td>
<td>“Yeah, I pretty much, if they did what I asked, and it was remotely close to what the topic was, I would give them full credits...” [Hope]</td>
</tr>
</tbody>
</table>

Thus, teachers in the affluent schools were still holding on to some rigor, but not the same amount as compared to in-person classes. However, the bar was extremely low to get a pass at high-need schools. In the absence of a grading system that gave some power to the teachers, high-need schools struggled a great deal to keep the students engaged and to get them to turn in assignments.

Teachers did their best to be fair and equitable to students under the constraints that they were operating in different schools. While most teachers talked about reducing expectations to varying degrees, Mike, one of the middle-level school teachers, emphasized that the new expectations had to be communicated clearly to be more fair and equitable. He says, “I feel like I created the opportunity for everybody to know what my class expectations were per week, by, you know, sharing it with parents and students alike...All I could do is communicate highly effectively of what the plan was, and be available for office hours every week so that I could support.”
Nevertheless, both affluent and high-need teachers felt that they were not able to be fair and equitable in some situations. Affluent school teachers, Amy and Adam, felt that they were not fair and equitable to some of their struggling learners because they couldn’t provide the same support to them as in a regular classroom. Amy said “So I would say no, that I don’t think that it was fair and equitable the way it is in a classroom setting because they have my support so much more in a classroom setting. And the student who needed me the most in the classroom were the ones that needed me differently in the online setting, and I didn’t know how to do it.”

In high-need schools, teachers felt a variety of different reasons as to why they were not fair and equitable, such as not being able to do anything about the poor home environments of students and not being able to differentiate. Hank and Hope also expressed that they felt that the Do No Harm policy made it unfair for kids who worked hard during the pandemic to receive the same grade as the ones who did nothing (but had a passing grade before going remote). It is worth mentioning that Hazel, who also had a Do No Harm grading system at her school, tried to acknowledge the effort of students in a different way in the absence of the traditional grading scheme. She says: “I did take a week where I looked at the students that have been doing a lot of work for me, as opposed to those who have chosen not to, and I did send letters home to each of those students. I wrote each of the students a card, telling them that I was thinking of them and thanking them for doing their work, and then included a special letter for their parents, commenting on how hard they were working.”

Apart from the common “Yes and No both” answers, Alissa was the only teacher who said yes, she found it easy to be fair and equitable, and Mia was the only teacher who said no, there was no way to be fair and equitable. Interestingly, they both referenced the grading system that their school had adopted to explain their point. They both felt that not having a traditional grading system helped them to be more equitable (for Alissa) and focus on building individual connections (for Mia). When asked were they able to be fair and equitable they said:
To summarize, the impact on students created a lot of challenges for teachers. In the face of these challenges, teachers tried to be as fair and equitable as possible by being available and adjusting their expectations. However, given the impact on students was severe for high-need schools, the way teachers adjust their expectations were also different. Next section discusses this in more detail.

**Theme 2: Priorities and Teacher Expectations**

In this section, I will show how the priorities and expectations changed for teachers after shifting to remote instruction during the COVID-19 lockdown.

**PRIORITIES**

After analyzing the entire transcript for priorities, 11 distinct phrases were identified and coded for 11 distinct priorities that came up during these interviews. Some were shared among many teachers, whereas others were explicitly mentioned by one teacher. It is important to note that some of these teachers described these priorities in a hierarchical way, however, for our purpose, we only report if the priority was mentioned or not. Table 6, below, shows all these different priorities and which teachers out of the 10 mentioned these in their answers to the first interview question:

<table>
<thead>
<tr>
<th>Q1. What were your PRIORITIES for your students after shifting to remote instruction during the COVID-19 pandemic?</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 5. Example of Alissa and Myra answers to being fair and equitable.</strong></td>
<td><strong>“I mean, that’s obviously a huge concern, um, the school insisting on everybody going on Pass vs Incomplete (Do No Harm grading system), made it much easier to be fair and equitable because it didn’t come down to this person got more points. And it just would have been hard given the circumstances that we were in, I think, so I feel like they (grading system) were fair and equitable in that everybody had all the opportunities to get that pass as many as they needed.”</strong> [Alissa]</td>
<td><strong>“Yeah, I think the answer to that is no. I think we were being very, very gentle, and focusing on individuals and relationships, really the purpose of switching that grading system (from traditional to Pass with distinction, Pass, and Fail). And that’s because there was really no way to be fair and equitable, in terms of, like grading a paper, given all the circumstances. So, I think we took the pressure-off.”</strong> [Mia]</td>
</tr>
</tbody>
</table>
Table 6. Frequency of phrases related to teachers’ new expectations.

<table>
<thead>
<tr>
<th>Phrase</th>
<th>Amy</th>
<th>Adam</th>
<th>Alissa</th>
<th>Mike</th>
<th>Mia</th>
<th>Myra</th>
<th>Henry</th>
<th>Hank</th>
<th>Hazel</th>
<th>Hope</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact and being available</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>8</td>
</tr>
<tr>
<td>Keeping students engaged</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>7</td>
</tr>
<tr>
<td>Health and safety</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>School relaxed the first two weeks</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
<tr>
<td>Food Security</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>High Emotional Needs</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
<tr>
<td>Routine was a priority</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Providing learning opportunities for all</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>School kept the same schedule for first two weeks</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Social-emotional wellbeing</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Academics were not the primary concern</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>1</td>
</tr>
</tbody>
</table>

According to the interview data, all teachers had a shift in their priorities. It was no longer the same for anyone. Traditional academic goals were not a priority for anyone anymore. There were some similarities and differences in the new priorities of teachers.
Following three were the most popular priorities for teachers from all three categories—affluent, middle-level, and high-need:

- Maintaining contact with students and being available for them
- Keeping students engaged
- Health and safety of students

In general, all teachers were concerned about the health and safety of their students, given the spread of the virus. Teachers were spending a lot of time trying to touch base with everyone to make sure students were okay, and made themselves available for students as much as possible. Once the basic health and safety was established via contact, most teachers mentioned that their priority was to keep their students engaged. As we will see later, one of the major challenges that teachers faced during this time was to keep students engaged in the new online world.

Table 7. An example of similarities of priorities among the three categories of schools.

<table>
<thead>
<tr>
<th>Phrase</th>
<th>Alissa (Affluent school)</th>
<th>Mike (Middle-level school)</th>
<th>Hank (High-need school)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact and being available</td>
<td>“My number one priority in March and through the Spring (2020) was keeping students engaged...I was worried about the safety and well being physically, mentally, emotionally, and educationally of my students. So, I really put a lot of effort into making opportunities for students just to, like, meet me and other groups of students to see them...”</td>
<td>“All I could do is communicate highly effectively of what the plan was, and be available for office hours every week. So that I could support them.”</td>
<td>“Our priorities were contact and keeping in contact with the students. In fact, we spent a lot of time you know, I spent more time emailing, calling parents, just checking on kids to make sure they, you know, everybody was getting what they needed...”</td>
</tr>
<tr>
<td>Keeping students engaged</td>
<td>“My number one priority was to create a routine and get them engaged in the routine...the number two priority was to get everybody involved, and then make sure they were okay.”</td>
<td>“Like I said, contacting was, keeping the kids, keeping in contact with the kids, and keeping them engaged was our number one priority.”</td>
<td></td>
</tr>
</tbody>
</table>

Apart from the above-mentioned common priorities (bold highlighted box in the table) among all teachers, there were some clear differences based on the three categories of schools. Where basic needs like food security and emotional health (basic levels of Maslow’s hierarchy of needs) was a priority for
high need school teachers, social-emotional wellbeing (level three of the hierarchy of needs) was a major concern for affluent school teachers. For teachers with middle-level student populations, emphasis was on routine and providing differentiated learning opportunities for all students.

Table 8. An example of differences among the three categories of schools.

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Hope (High-need school)</th>
<th>Mia (middle-level school)</th>
<th>Amy (Affluent school)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority</td>
<td>Food security and High Emotional Needs</td>
<td>Routine</td>
<td>Social-emotional wellbeing</td>
</tr>
<tr>
<td>Example</td>
<td>“Our biggest priorities were their safety and their basic needs. Before we could do anything else was to make sure that they were fed, and that they were all in a safe place.”</td>
<td>“Emotionally, the first month I literally was talking to either students or parents from 6:00 in the morning to 9:00 at night, either via emails or phone calls. The emotional needs of their families were so high. The anxiety levels were all over the place.”</td>
<td>“Yeah, pretty quickly, my priorities shifted to the social-emotional, like well-being of the students, because I knew what it was doing to me and the weight that it felt like.”</td>
</tr>
</tbody>
</table>

It is evident from the table that for Hope, a high-need school teacher, food security and providing support for high emotional needs of students was a priority, whereas for Mia, routine was the focus, and for Amy, the social-emotional well-being of her students was her primary concern.

It is also important to mention how the participants’ school reacted to the sudden lockdown of schools in Maine, in March 2020, due to COVID-19 pandemic. Three out of four high need school teachers—Henry, Hazel, and Hope—mentioned that their school relaxed the first two weeks to absorb the shock and give everyone some time to get back on their feet. In contrast, for affluent schools, two out of three schools kept the same school schedule until they realized that teachers and students were starting to burn out. One middle-level school also relaxed their expectations for the first two weeks.
For example Hazel, a high need school science teacher, said the following about the transition to remote learning: “So initially, we were told that we were going to be out for two weeks, which would basically it sounded like it’s gonna be till the end of March, and then we might come back in April. So we were told then to just keep some sort of education going, well give them activities to do, give them things to do. And then in April, that we were told that we weren’t coming back, and that we needed to find ways to hit content that needed, that students hadn’t had yet.”

Amy, a teacher from an affluent private school in Maine, mentioned the following about the transition: “So, they gave us that first Monday as a professional development day. And then we stuck to our regular school schedule, for the first two weeks of the shutdown. And at the end of the two weeks, the admin made the decision not to continue doing that, because we were meeting with all of our classes at their regular time for their regular length of time, the students were in front of a screen all day…So there was a lot of feedback about how overwhelmed the student were and how exhausted teachers were”

Affluent schools responded very differently compared to the high need school. Research shows that it takes time for both students and teachers to adjust in the online environment (Conard, 2002; Kenny, 2002). At the same time, not all teachers spoke of this transition time. Alissa, Mia, Myra, and Hank did not mention anything explicitly about the first two weeks while talking about different questions.

In summary, all schools were trying to meet various hierarchy of needs for their students. High-need schools were more concerned about lower level needs of the Maslow’s triangle, such as physiological needs and safety needs. Affluent schools seemed to struggle more with level three on the hierarchy of needs: love, affection, and belongingness through their social-emotional focus. middle-level schools had some characteristics of both, which makes sense as it had a mixed student population in terms of socio-economic status.
TEACHER EXPECTATIONS

Q2. Before we moved to remote instruction, what were your EXPECTATIONS about STUDENT LEARNING OUTCOMES? How, if at all, did these shift after moving to remote instruction?

When teachers in all three categories were asked “how, if at all, did your expectation for students' learning outcomes shift…,” and their answers were analyzed, the results were pretty consistent with previous research about teachers' expectations based on student background and other factors. These answers can also be successfully correlated to the priorities that these teachers had as per the last section.

As described in chapter 2, studies show that teacher’s expectations play an essential role in students' learning outcomes (Rosenthal & Jacobsen, 1968). After the March 2020 COVID-19 lockdown, teachers in all schools reduced their expectations for students’ learning outcomes for many valid reasons. Nine out of ten teachers explicitly stated that their expectations, which were more rigorous initially, had reduced for either some or all of their students (see Table 9 below).

Adam, a private school teacher, shared the following about his expectations pre-pandemic: “I tell the students that I have an expectation of them, that’s different than other teachers, that if you take a history class, your teacher doesn’t expect you to be a functioning historian at the end of the year. But, I tell my students that I do expect them to be functioning physicists at the end of the year.”

Mia, a school teacher with middle-level student population, mentioned the following about her shift in expectations post-pandemic when schools went remote in Maine: “I mean, in the constantly changing environment, we were building the plane as we were flying it, that was a real challenge for all of us…we weren’t sure about things like exams and finals…so, you know, really hard to give up a lot of the traditional notions of what assessment is and what it looks like.”

Henry, a high need school teacher, said the following about his new expectations after moving to remote instruction: “felt like..we’re not going to stick to teaching the same things that we otherwise would have...So I thought about the lessons that I had that were more interesting in general, and more
applicable to everyday life and in try to do those and make them straightforward enough, so that it was not too burdensome for students to engage with, now, that also meant that it was kind of a low ceiling.”

Table 9. Frequency of phrases related to new teacher expectations.

<table>
<thead>
<tr>
<th>Phrase</th>
<th>Amy</th>
<th>Adam</th>
<th>Alissa</th>
<th>Mike</th>
<th>Mia</th>
<th>Myra</th>
<th>Henry</th>
<th>Hank</th>
<th>Hazel</th>
<th>Hope</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations were reduced for some or all students</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>9</td>
</tr>
<tr>
<td>Expectations were same for Advance Placement (AP) classes</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Expectations were reduced a bit for Hons classes</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Expectations were reduced a lot for lower-level classes only</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Provided extra opportunities, didn’t expect learning</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Expectations were more holistic and individual</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>1</td>
</tr>
<tr>
<td>Expectations were reduced a lot, to attempt, effort, and engagement, for all classes</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
</tbody>
</table>

So, in general, teachers pulled back their expectations because of various challenges (to be discussed in Theme 3 and 4) that a sudden shift to remote instruction had created for teachers and students. It is worth noting that Mia didn't explicitly mention that her expectations were reduced but said that they were different to accommodate the change.

Even though almost all teachers mentioned that there was a shift in their expectation, there were some characteristic differences in these shifts between affluent and high-need schools. Adam and Alissa,
the two out of three affluent school teachers, mentioned that their expectations for AP classes did not change, for honors classes it reduced down a bit, and only for lower classes it went way down. However, all high-need school teachers stated that their expectations went way down, irrespective of the class-level.

Below are some phrases used by teachers in two different categories of schools when describing the shift in their expectations for students learning outcomes:

Table 10. Example of new teacher expectations of affluent vs high-need school teachers.

<table>
<thead>
<tr>
<th>Affluent school teachers</th>
<th>High-need school teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amy: “I didn’t think at first that I would have this in my expectations…I just couldn’t cover the same amount of material, or in the same way.”</td>
<td>Henry: “I think my intention was to keep them, to keep their attention and to keep them engaged in learning something.”</td>
</tr>
<tr>
<td>Adam: “When COVID-19 held, I had to lower my expectations as far as the depth of coverage and depth of the problems that I could ask the students to solve.”</td>
<td>Hank: “But afterwards (lockdown), that (expectations), dropped off quite a bit. Like I said, keeping in contact with kids and keeping them engaged was our number one priority.” “You know, my bottom line was, if they got half of the assignment done that were presented to them, we gave them a pass (grading system- pass/fail/incomplete)...”</td>
</tr>
<tr>
<td>“But that was not covered on the AP exam this year, we actually covered all of the material on the AP exam, by the end of the school year...”</td>
<td>Hazel: “So my expectations had to shift significantly, because I really didn’t think it was fair for those working hard, and trying to get the assignments in to have lower grades (grading system-do no harm).” “And if they turned it in, they got credit for it.”</td>
</tr>
<tr>
<td>Alissa: “When we went to remote learning, I don’t have control over things like testing. So, I shifted that very much, for what the expectations were, instead to wanting them to have an experience, and some exposure and some practice with all of the topics...it wasn’t comprehensive.”</td>
<td>Hope: “...my expectations of where they were at the end had kind of just gone. And it was more of a just, hey, you’re there, you’re participating, you’re attempting to do this. That’s all I can ask for, so very different (expectations).”</td>
</tr>
</tbody>
</table>

This interview data is somewhat consistent with the already existing research data. Studies show that when teachers set high expectations, their students follow suit (Alvidrez & Weinstein, 1999; Weinstein, 2002, 2008). However, when teachers set low expectations for students, especially for the ones...
coming from already disadvantaged backgrounds, they can also follow suit and their learning outcomes are compromised (McKown & Weinstein, 2008; Rubie-Davis et al., 2006).

Larger groups such as entire school populations influence teacher expectations too. Schools with large populations of socio-economically disadvantaged groups face a culture of teacher “deficit” attitude towards students, resulting in low expectations for students and a consequential lack of academic rigor (Rodriquez, 2012). These schools’ cultures, or “expectation climates,” influenced teachers to have lower expectations of their students (Thys & Van Houtte, 2016). This can suggest why teachers in high-need schools, where more than 50% of students are on free or reduced lunch, adopted such a drastically low expectation relative to middle-level and affluent schools.

It is also worth noting that at least one teacher in all three categories said that they were trying to provide extra learning opportunities, mainly for motivated students, but didn’t explicitly expect learning to happen. Here is how Mike puts it: “But kids, some kids were asking for more…and so then I was like, well, if they are asking to do more, I should challenge them. So I started a model of every Google Form test, then had a second one for extra extra points, and you could take it…I just felt those students deserved it. They are asking for it. And so, I felt like I had to figure out a way to offer that.”

Thus, teachers in all schools had reduced expectations as their priorities were not student learning outcomes, as traditionally, but making sure that their students were okay and engaged in the new online environment. Teachers in affluent schools prioritized social-emotional well-being of students, in middle-level schools routine was emphasized, and in high need schools, high emotional needs were emphasized. These priorities were based on how the students in these different schools were impacted (Theme 1).

Teachers in high-need schools, where most students are from low socioeconomic backgrounds, had very low expectations for students' learning outcomes after the lockdown. There are many reasons for these lower expectations: teacher’s prioritized students' basic needs like food security, physical health and
safety, and emotional health over learning outcomes. Teachers in these schools spent a lot more time dealing with the emotional health and well-being of students and parents compared to teachers who teach relatively affluent students. Other reasons why high-need school teachers had significantly low expectations were because of lack of support from the students’ home environment, lack of guidance and support from the administration, and teacher’s personal challenges, as will be discussed below when analyzing Themes 3 and 4.

**Theme 3: Teaching & Assessment with Challenges**

The core investigation of this study was to understand how teachers experienced the process of assessment during the COVID-19 remote instruction in spring 2020. However, it was realized immediately after the first round of analysis that teachers spent a lot more time talking about their teaching methods and practices than they did about assessment. It is difficult to talk about assessment without talking about teaching, as they are highly intertwined. Thus, based on the interview data, the research questions were redefined and the focus was zoomed out to capture both the experience of teaching and assessment for secondary science teachers in Maine rather than just assessment.

This theme has four parts to it: assessment, challenges with assessment, teaching, and challenges with teaching. So, we will see the shift in assessment criteria and methods first and the challenges associated with them, and then we will discuss teaching practices and its challenges. It is hard to keep the distinction between the two, so wherever necessary, the connection between the two will be discussed.

**ASSESSMENT & Its CHALLENGES**

Assessment, which was the initial topic of focus for this study was the topic of three questions (Q.3, Q.4, and Q.6) allowing for insight into how the assessment methods, assessment criteria, assessment of three NGSS dimensions, and the use of formative assessment shifted for teachers following the move to remote instruction.
Drawing inspiration from teaching terminologies (Figure 3) of what different terms (approach, methods, strategy, and technique) mean, assessment criteria can be loosely linked to teachers' grading approach. It is a broader category that reflects a set of beliefs that a teacher has about what deserves to be graded, given the situation of the learner. Assessment methods refers to the procedures and tasks that teachers used to assess student learning. These could be for both formative or summative. Following three questions regarding assessment were asked from the participants:

(Q3.) How, if at all, did your ASSESSMENT METHOD shift following the move to remote instruction? How, if at all, did your ASSESSMENT CRITERIA shift following the move to remote instruction? What were the reasons for any shifts that happened?

(Q4.) To be more specific, what challenges, if any, did you face in assessing students in the context of the three NGSS dimensions:
   (i) Core Content (ii) Cross-cutting concepts (iii) Science and Engineering Practices

(Q6.) How have you used FORMATIVE ASSESSMENT to observe your students’ learning during this time of remote instruction? Did the change in platform or methods (for example, Zoom, Google classroom, etc.) influence the feedback process?

As mentioned in the literature review, if we are trying to teach students in three-dimensional ways (NGSS), we need to know how to assess students in each of these three dimensions. So, Q4. targets how do teachers assess students in these three dimensions, and how did these changes once schools went remote. All three questions are shown above.

For the most part, how teachers assessed students changed. As many as 15 codes for the change in assessment and 6 codes for challenges with assessment were identified. Generally speaking, as teaching and assessment went remote, the following three major shifts happened (see Table 11):

- Grading system changed for the school (for 8 of 10)
- Assessment became streamlined
- Science and Engineering Practices (SEPs) were hard to assess, and content became a priority
As soon as the COVID-19 lockdown happened and schools went remote, the first thing that most school districts did was to change the grading system. From proficiency or number based, they went into more broad categories of grades such as Pass/Fail, Pass/Incomplete, etc. The amount of interaction time between the teachers and students had reduced significantly, thus, assessment was not as comprehensive anymore, and got streamlined. Moreover, not just the quantity of assessment, but also the quality of it got affected. Almost all teachers explicitly mentioned that they found it hard to assess Science and Engineering Practices (SEPs) in the new online environment, and thus, content, which was relatively easier to assess, became their primary focus. We will see these three changes in detail below.

In terms of challenges (see Table 12), one of the most common challenges among all teachers was that they missed not being able to collect informal formative assessment data (such as facial expressions, body posture, hand gesture, etc.) because of being on an online platform (like Zoom) instead of the classroom. As Amy said, “So, the most natural thing that happened in the classroom that I didn’t realize was all of the data you collect, just by being around your students, when you walk around and notice, wow, their notebooks looking a little blank, or they didn’t do those practice problems, and oh, they’re so behind. Like, I would never have thought of assessing student learning until I couldn’t do it anymore on Zoom...for most part, I lost a lot of that very casual data that I was collecting.”

So, teachers were not able to provide much feedback when they were interacting with students in small groups or full-class on Zoom, which research shows is significant (Yorke, 2003), and had to wait till they received their work to give any feedback.
Table 11. Frequency phrases related to how assessment happened.

<table>
<thead>
<tr>
<th>Phrase</th>
<th>Amy</th>
<th>Adam</th>
<th>Alissa</th>
<th>Mike</th>
<th>Mia</th>
<th>Myra</th>
<th>Henry</th>
<th>Hank</th>
<th>Hazel</th>
<th>Hope</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grading system changed</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>8</td>
</tr>
<tr>
<td>Streamlined assessment</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>10</td>
</tr>
<tr>
<td>DCI(^1) easiest, SEPs(^2) hardest</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>9</td>
</tr>
<tr>
<td>To assess</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used familiar assessment design</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>Used framework</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEP tried in some fashion</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
<tr>
<td>Commented on CCCs(^3)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>4</td>
</tr>
<tr>
<td>Participation graded</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>✔</td>
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<tr>
<td>Participated</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Very low bar</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>No summative</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>5</td>
</tr>
<tr>
<td>More individualized feedback given</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>7</td>
</tr>
<tr>
<td>Relaxed timeline for assignments</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
<tr>
<td>Less independent tests and quizzes</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Grades</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Provided individualized assessment</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>1</td>
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<tr>
<td>Extra opportunities to succeed</td>
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<td></td>
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<td></td>
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<tr>
<td>Highly relaxed rigor and timeline</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>✔</td>
<td>✔</td>
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<td>4</td>
</tr>
<tr>
<td>for assignments</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Partial completion and attempt was</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>✔</td>
<td>✔</td>
<td>4</td>
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<td>acceptable</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>No real formative</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
</tbody>
</table>

1 Disciplinary Core Ideas (DCI)  
2 Science and Engineering Practices (SEPs)  
3 Cross-cutting Concepts
Changing the grading system was a way for school districts to adjust to the circumstances and perhaps relieve students and parents of some stress. The whole world was going through a lot of stress and anxiety because of the pandemic during Spring 2020. Perhaps schools acted to these changes by taking the complete child into account, who were hugely impacted as seen in Theme 1. As Mia mentioned in her interview, “We were concerned that everyone landed in a safe spot and was into a routine. We switched the grading system very quickly from A–F to Pass-Fail grading during that time too…the grading system was kind of implemented to reflect the changes and people’s lives during that time.”

Another reason to change the grading system was perhaps that it is hard to proctor things like tests and exams on platforms like Zoom, so a lot of the conventional testing systems were not useful anymore. As Mia said, “the pass/fail system was implemented because there is a lot of kind of click your way to success in remote learning. So, we didn’t feel like there was any authenticity to a lot of the
Another teacher Mike, from mixed schools said, “Okay, I had some students that were off my radar forever, and then all of a sudden, it dinged on my computer, that they finished their assessment. And just and just imagine the lack of control. I mean, I had no idea if they were doing it, if mom dad were doing it, their dog fish, like, I had no idea who was clicking which buttons, but I had no capacity to really monitor that.”

On the topic of policing and cheating, it might be worth noting that Amy and Adam, the two teachers whose schools didn’t change the grading system, struggled with cheating issues (see Table 12). Amy tried to deal with these challenges by doing more one-on-one assessments, like oral exams, but she immediately realized how time-consuming, and thus, non-sustainable it was. In contrast, Adam dealt with the possibility of cheating by redefining his perspective of assessment and not caring too much about it. “In the situation, given that my priority was their well-being as a person first, and their academic performance as a physics student second, I simply didn’t worry about it (cheating). I believe that assessment is not just to give them a grade, but the assessment itself can be a learning opportunity for them.”

Table 13. The new grading system for all our participants: More details of what this system means are provided in the minor theme 3 in the next chapter.

<table>
<thead>
<tr>
<th>NEW GRADING SYSTEM</th>
<th>TEACHER NAME</th>
<th>SCHOOL CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change in grading system</td>
<td>Amy</td>
<td>Affluent</td>
</tr>
<tr>
<td>No change in grading system</td>
<td>Adam</td>
<td>Affluent</td>
</tr>
<tr>
<td>Number Score/Pass with Remediation/Fail</td>
<td>Mike</td>
<td>middle-level</td>
</tr>
<tr>
<td>Pass with distinction/Pass/Fail</td>
<td>Mia</td>
<td>middle-level</td>
</tr>
<tr>
<td>Pass/Incomplete/Fail</td>
<td>Myra</td>
<td>middle-level</td>
</tr>
<tr>
<td>Pass/Incomplete</td>
<td>Alissa</td>
<td>Affluent</td>
</tr>
<tr>
<td>Pass/Fail</td>
<td>Hank</td>
<td>High-need</td>
</tr>
<tr>
<td>Do No Harm (DNH)</td>
<td>Henry</td>
<td>High-need</td>
</tr>
<tr>
<td>Do No Harm (DNH)</td>
<td>Hazel</td>
<td>High-need</td>
</tr>
<tr>
<td>Do No Harm (DNH)</td>
<td>Hope</td>
<td>High-need</td>
</tr>
</tbody>
</table>
In addition, yet another reason to change the grading system could be that the instruction time and rigor got reduced, so the amount of content that students were covering was significantly low (see Table 17). This happened because of the slow pace and various challenges of remote instruction. This leads nicely into our most popular code about change in assessment: streamlined assessment.

Every teacher, from all three categories, in some capacity mentioned that the assessments were streamlined. Teachers reduced the number of assessments, the rigor of it, and the number of times it went through the cycle of back and forth feedback between the teacher and the student. An example of teachers streamlining their assessment in each category of school has been given.

Table 14. Example for the phrase “streamlined assessment” from all three categories of schools.

<table>
<thead>
<tr>
<th>Affluent School (Alissa)</th>
<th>Middle-level School (Mike)</th>
<th>High-need School (Hazel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“If, when we were in school, that feedback that I give them, they would be required to then take another step and show the corrections that they made based on the feedback. But with remote learning, it was hard, all the back and forth electronics, and so I dropped that last step off.”</td>
<td>“They (assessments) became very streamlined and efficient summative assessments….I didn't do a diverse plethora of assessments in the gradebook…let’s say that I had 15 assessments at the end of the quarter, and now they had like, 4 or 5 over two quarters.”</td>
<td>“(Before)...students hand me their work...I will tell them what I want them to fix, pass it back to them, and then they might fix it, I might have it fixed two or three times depending on where they are. (After)..because if a student did the work, I gave him 100 in remote learning.”</td>
</tr>
</tbody>
</table>

However, even though assessment got streamlined for all schools, the degree to which it was streamlined varied greatly between the affluent and high-need schools. Affluent school teachers Amy and Adam were teaching synchronously on Zoom with a regular school schedule. They were still doing summative assessments, though with flexibility and leniency. Tests and quizzes were not as independent, and grading in general was more forgiving because of the low instruction time and challenges of remote learning. Alissa also was holding her students accountable for minimum mastery of the content. She provided students with more individualized assessment and multiple opportunities to succeed. Thus, affluent school teachers were still assessing their students frequently and expecting some learning.
In contrast, high-need school teachers did not do any traditional summative assessment, such as end unit tests or quizzes. They mostly used asynchronous assignments to assign passing grades. Their old formative assessments became their new summative assessments, essentially. They had very low bars for their students to pass, the rigor and timeline for assignments were highly relaxed, even effort and partial completion was enough, there were no formative assessments involved as there were no synchronous classes, and every assignment got credited. Considering what we learned from Theme 1 (Impact on students and equity issue) and the fact that most high-need schools had a Do No Harm policy, these highly relaxed assessments can be seen as a response to the challenges of the time. Quotes from teachers illustrate this contrast in the two categories of schools:

Table 15. Examples of assessment methods and practices at affluent vs high-need schools.

<table>
<thead>
<tr>
<th>Affluent school teachers</th>
<th>High-need school teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amy: “I think I heavily scaffolded student learning...so the quizzes, I think, I had a lot of scaffolding. And then when I got to the tests, I tried to remove some of it, of course, but still kept it pretty scaffolded. Yeah, so there was a lot less rigor in the assessment. Yeah. They were less independent.”</td>
<td>Henry: “I did not do that (formative assessment) at all, I didn’t really do any question answering because when I tried it, when we went remote, everyone remained silent. You know, so I abandoned ship on that. Let’s see. And then, I would casually give paper quizzes or like, and I did not do that when we went remote.”</td>
</tr>
<tr>
<td>Adam: “...and with online learning, we just didn’t have the contact time. And we couldn’t give students the same amount of homework without overwhelming them. It just was not as effective, in my opinion. But I think we did the best we could, and I think the students continued to learn in a less efficient, effective way, but real learning still was accomplished.”</td>
<td>Hank: “I didn’t give any summative from March, you know till school ended. No summative, and that was our policy for the school. We backed away from that.”</td>
</tr>
<tr>
<td>Alissa: “...students who were planning to take AP, mastery of all of the topics should really be their goal. So, I provided opportunities for students to do all of those things, but didn’t expect it from everyone, I let them self-select. Self-selecting on that seemed to be okay.”</td>
<td>“You know, my bottom line was, if they got half of the assignment done that was presented to them, we gave them a pass.”</td>
</tr>
<tr>
<td></td>
<td>Hazel: “Well, in terms of the assessment, it was all just the formative stuff. And if they turned it in, they got credit for it. Okay. And that was dictated to us, we had to do it that way, we could not take anything away from somebody who chose to not turn stuff in (Do No Harm grading system). And I didn’t feel it was fair to take points off of anything for a student who turned it in and tried at least.”</td>
</tr>
<tr>
<td></td>
<td>Hope: “When I shifted to remote learning, sometimes it (expectations) was just that they participated, that they were joining once a week, or, you know, sending an email...my assessment was all formative (credited though), really, there was no true summative once I got to remote...”</td>
</tr>
</tbody>
</table>
Evidence suggests one further reason why there was a change in the grading system. One last suspected reason why eight of the ten teachers’ schools had changed the grading system was attendance. Some teachers argued that students were checking out, and thus, keeping the grading system the same (or expecting the same rigor of work to pass) would have resulted in many students failing. As time went on student engagement declined and a lot of students were either completely absent or involved minimally, especially at the high-need school. As Alissa noted, “...the number of students showing up to the instructional time just drastically dropped off over the semester...and so if we kept the expectations as high as they had been, we would have had two thirds of students that would have no chance to get their credit to move forward.”

It is unclear whether the new grading system accommodated or perpetuated the absenteeism of students. Decisions about grading schemes were made at the very beginning of the remote instruction phase, whereas most teachers saw the decline in attendance after April break. One strong piece of evidence to support the claim that the grading system might have perpetuated the absenteeism comes from Amy, whose school had synchronous teaching and did not change the grading system. She said, “This is probably where my school was very different from some of my friends that teach in schools near me. I had 100% attendance, many times, many classes...then in some of my classes, my attendance was higher.” The reasoning behind this according to her was that students were not involved with extracurriculars that would make them miss the classes. It might be worth noting that Adam, the second teacher whose grading system had not changed, did not mention anything about attendance explicitly.

Changes to the grading system also created different types of emotional challenges for teachers. At least, three were identified and noted in the Challenge of Assessment Table (see Table 12): mindset shift, lack of control, and internal conflict.
Once schools changed their grading scheme and relaxed the standards for a student to get a pass, many teachers struggled to give up their usual rigor and adapt to the new idea. Mia mentions, “You know, you really had to give up a lot of the traditional notions of what assessment is and what it looks like, and focus on kind of an individual student and the relationship base.” Another big challenge was the lack of control that teachers felt during this time. Henry shared, “there were no clear directions from the admin as to what I should do about students that were doing late work.” So, students were turning in assignments as much as six weeks late, which was challenging for him to handle.

Not all teachers were happy about the grading system their district had adopted, especially the ones that had adopted Do No Harm policies (high-need schools). Because it freed all the students who already had a passing score, and teachers did not put a lot of specificity in grading student work, they felt it was only fair to pass the ones who were doing work, if others (who were already passing) were getting away with doing no work. Amy, who was on the other extreme, with numeric grading and summatives, was also not satisfied as she felt the students felt the pressure too much. Nevertheless, some teachers were very accepting and happy about the grading system that their district had adopted. This is discussed in the end section as a separate emergent finding.

Apart from changes to the grading system and assessments being streamlined, the last popular answer among all teachers was that they found it easier to teach and assess content (Disciplinary Core Ideas, DCI) than Science and Engineering Practices (SEPs) or Crosscutting Concepts (CCCs). Teachers described logistical reasons involved in teaching and assessing the latter two. However, some teachers did go out of their way to try and still teach some practices. Mike says, “And I tried to put as much of that (SEPs and CCCs) into the assignments...But I would say, core content became the primary focus for efficiency reasons.” One common response to Q4 was that most teachers avoided even commenting about Crosscutting Concepts or admitted that they had never assessed it. This is also discussed as an emerging finding at the end of this chapter.
In the assessment table (Table 11), the codes enclosed in dash lines (very low bar, no summative, and more individualized feedback) represent the similarity between Alissa, an affluent school teacher with high-need school teachers. Given the discussion above, the assumption that these similarities are because of adopting a grading system similar to high-need schools is warranted. As discussed above, high-need schools had very low bars to get a pass for students, and they did not do any summative assessments as such either. This was true for Alissa’s lower level classes as well. Moreover, most of the schools who were doing asynchronous classes (including Alissa and high-need teachers Henry, Hank, Hazel, and Hope) had time on their hands to give more individualized feedback on student work. As we will see in the differentiation of instruction (emergent finding) at the end of this chapter, this helped teachers to give more individualized attention to some students.

In reference to the assessment triangle (cognition, observation, and interpretation) discussed in the literature review (Chapter 2), teachers in all schools found it hard to teach the cognitive models that they wished to develop among their students. Teachers were aware of the competencies they needed to teach in their subject and grade, however, they did not have the means to teach it or assess whether they had done so. Moreover, the task design process to elicit learning was also compromised because of the change in platform from classroom to online instruction. And last but not the least, most teachers were not looking at student data with much depth and expectations for the quality of work was low. Thus, the assessment triangle in all its three pillars–cognition, observation, and interpretations–was compromised.

**TEACHING & its CHALLENGES**

After discussing assessment methods, criteria and NGSS three-dimensional assessment, teachers were asked how their teaching practices were influenced by these changes in assessment practices. Eighteen distinct codes appeared for how teachers were teaching, and 12 codes appeared for the challenges they faced during the teaching process. Following question was asked:

(Q5.) How did these changes in assessment influence your TEACHING PRACTICES?
Table 16. Frequency of phrases related to teaching practices.

<table>
<thead>
<tr>
<th>Phrase</th>
<th>Amy</th>
<th>Adam</th>
<th>Alissa</th>
<th>Mike</th>
<th>Mia</th>
<th>Myra</th>
<th>Henry</th>
<th>Hank</th>
<th>Hazel</th>
<th>Hope</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching happened via Zoom/Meets/Hangouts</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>10</td>
</tr>
<tr>
<td>Teaching time and rigor reduced</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>10</td>
</tr>
<tr>
<td>New fun things experimented</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>Demo, Virtual Lab, and PhET</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>5</td>
</tr>
<tr>
<td>Had used Google Classroom before</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>From Active-Learning to lecture</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Taught and prepared students for Codes unique to Affluent Schools</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Regular synchronous classes</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Less stress on recall and reinforcement</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Differentiation of Instruction did not happen during synchronous</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Mostly asynchronous and one-on-one</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>7</td>
</tr>
<tr>
<td>One-on-one support for attending students, struggling learners and</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>4</td>
</tr>
<tr>
<td>Teaching practices still figuring out</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Used online resources directly</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Classwork became homework Codes unique to high-need Schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Lack of Zoom usage knowledge</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Teaching practices not satisfied</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
<tr>
<td>Spent lot of time on reviewing</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>No direct instruction</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 17. Frequency of phrases related to challenges with teaching.

<table>
<thead>
<tr>
<th>Phrase</th>
<th>Amy</th>
<th>Adam</th>
<th>Alissa</th>
<th>Mike</th>
<th>Mia</th>
<th>Myra</th>
<th>Henry</th>
<th>Hank</th>
<th>Hazel</th>
<th>Hope</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard to keep students engaged</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>10</td>
</tr>
<tr>
<td>Learning the new platform (Zoom/Google Classroom/Meet/etc)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>10</td>
</tr>
<tr>
<td>No group work</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>10</td>
</tr>
<tr>
<td>Challenged with replacing hands-on and active learning activities</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>Teaching online was exhausting &amp; time consuming</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>Zoom silence</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>5</td>
</tr>
<tr>
<td>Attendance &amp; engagement went down with time</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>6</td>
</tr>
<tr>
<td>Project-based fun classes became dull</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3</td>
</tr>
<tr>
<td>Couldn’t cover the material with same depth and speed</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>2</td>
</tr>
<tr>
<td>Reflective teaching and in-depth conversations got affected</td>
<td>✔</td>
<td>✔</td>
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<td>2</td>
</tr>
<tr>
<td>Felt the time constraint</td>
<td>✔</td>
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<td>2</td>
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<tr>
<td>Attention span challenge on Zoom</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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</table>

When all the phrases were counted for frequency, the following four were most popular among all teachers for how their new teaching practices had changed (see Table 16 above):

- Teaching happened via Zoom/Google Meets/Google Hangouts
- Teaching rigor and time was reduced
- Teachers tried new and fun things
• Some teachers also tried demos, virtual labs, PhET simulations, etc.

We will see how each of these four codes are connected with other codes that appeared in Table 16 and Table 17 below.

The first big change as teaching went remote was that teachers interacted with students via online mediums. Not only that, they also used online learning management tools such as Google Classrooms to communicate information and do assessment. Many teachers mentioned this as a challenge too (see Table 17), as most of them were not familiar (except Alissa, Henry, and Hazel) with how to use these new online tools. Due to the suddenness of the transition, they also did not receive any formal training for these platforms, at least for the Spring 2020. However, as we will see in Theme 5, many of these teachers also expressed gratitude to have learned these technology pieces, especially for Google Classroom and feel that they are going to use these even in regular classrooms. Hank, who is a high-need school teacher, shared, “my personal challenges, in assessing, you know, getting used to the new platforms, you know, the synchronous classrooms were very new.” Amy, who is an affluent school teacher, said, “I think I’m going to continue using Google Classroom. I mean, I wish we had different learning platforms like Canvas or Moodle, but Google Classroom is still pretty good. I think it’s going to become my student anchor going forward.”

Next, the second big change was that teaching rigor and time was reduced. This is not a surprise, as we already saw in the above section that this was one of the reasons why teachers streamlined their assessments. Teaching on an online platform (such as Zoom) is hard, especially when you don’t have things set up in advance. Student-teacher interactions are limited, especially if students choose to not turn on their camera. Often, it is hard to do group work, unless one has practice with Breakout Rooms and how to use a google doc simultaneously to gauge progress. The lack of sense of community (as there was no collaborative work) among students can have a negative effect, leaving some feeling isolated or even excluded from the learning process (Sadera et al., 2009). Most of these happened as we can see in Table 16 and 17.
Moreover, hands-on and active learning strategies that a teacher can use in a regular classroom do not translate all that well into the online world. And those teachers who tried to teach synchronously expressed that it felt like the classroom became a more traditional lecture. Finally, perhaps another reason to reduce the time and rigor of instruction when teaching went remote was that online classes can be exhausting and it is hard to hold attention span for as long as in a regular classroom.

Even though all teachers faced these various challenges and restrictions while trying to teach and assess online, and thus reduced their rigor for both teaching and assessment, several changes were unique for high-needs compared to affluent schools. Affluent school teachers still taught traditional synchronous classes on Zoom and prepared their students for high-stake tests such as Advanced Placement, and struggled the most with the above-mentioned attention span issue. They struggled to cover the material with the same depth and speed, and realized that they had to reduce the recall and reinforcement cycles for restricted time reasons. Their usual rich and interactive teaching style suffered and they found that it was extremely hard to do differentiation in synchronous classes on Zoom, mostly because of lack of informal data about their students. Their expectations were lower than usual so their methods of more directive instruction and less feedback and options for students were also similar to teachers with low expectations (Rubie-Davies, 2007), for all valid reasons and challenges of teaching remotely for the first time in the lockdown of March 2020.

In contrast, high-need school teachers reduced the expectations much more and the rigor was highly compromised. They did not have any direct instruction or synchronous classes, for the most part, and seem to lack knowledge of how to use features in online platforms (in August 2020 when the lockdown was new). Their primary way of teaching was asynchronous assignments and providing one-on-one support for those students who were showing up. They struggled with absenteeism and thus spent more time reviewing than covering new content. They used many online resources directly, and most of their classwork (before remote learning) became their homework for their students and thus was graded.
Some of them were still figuring out their teaching practices and were not happy with the current ones.

Table 18, below, shows contrasts between the affluent and high-need teachers using their answers quotes:

Table 18. Descriptive examples of affluent and high-need school teachers regarding changes to their teaching due to the pandemic.

<table>
<thead>
<tr>
<th>Affluent school teachers</th>
<th>High-need school teachers</th>
</tr>
</thead>
</table>
| **Amy:** “We kept our regular schedule, with a lot of synchronous teaching.”
“I did a lot of Breakout Rooms, so they could talk to each other because it was overwhelming how silent Zoom is.”
“I also realized that I wasn’t able to do the same amount (content)...the amount I was able to cover in the same amount of time was definitely decreased.”
“Differentiation is something I had a better handle of in the regular classroom setting.”
| **Hazel:** “I never used Breakout Rooms, now if we had to do this again, in fall, I definitely have thoughts on how I would use them differently.”
“My class sizes are usually small enough that I tend to do a lot of individualized feedback instead of the whole group. So that was still available through the Zoom, and I was able to reach out to students.”
| **Adam:** “I noticed the students struggled more than normal to get through the material once we had made the change to online instruction.”
“The kids were in a good position AP Physics wise, they were all prepared for this year’s test.”
| **Hank:** “We met for 30 mins for the whole week.”
“We lost contact with several of those kids (internet issue ones). You know, I finally got in touch with the kid’s grandmother, and she says, “I will relay the message if I see them,” you are going, yeah, you know, it is frustrating sometimes.”
| **Alissa:** “Well, knowing that I wasn’t going to ask them any recall, I didn’t do any activities that would have reinforced them, practicing or learning things that were memorizations, you know.”
| **Henry:** “In terms of, like physics, I would assign the video relevant to the content on Khan Academy...I assigned the assignments in the video that went with them...I would go over any questions or concerns they had, but I did not deliver content to my physics class.”
| **Hope:** “I’m still trying to figure out how my teaching practices are going to match this online platform.”
“I didn’t do as much Zoom and video as I wanted to...some kids preferred to Zoom in with me, so we can have conversations, which was nice, especially for my lower achiever.”

In summary, teachers in affluent schools had relatively higher expectations as they taught and assessed compared to teachers in high-need schools. Different teacher expectations lead to different teaching practices and assessment designs. These results are consistent with work by Dulfer, who showed that higher teacher expectations were found in a high-SES school than in a low-SES school, which
resulted in teachers using different pedagogical approaches (Dulfer, 2015). The pandemic further amplified this difference that already existed between these schools.

The third big change that happened when teaching went remote was that teachers tried a lot of new fun things with their students. Teachers felt this was needed as it was hard for teachers to keep their students engaged in remote instruction. All teachers struggled to keep their students engaged (see Table 17) and most of them also listed engagement being one of their priorities (Table 6). It is worth noting that teachers in general work on engagement in a regular classroom, where it is easier when students are in the same space. In contrast, a lot of the fun, engaging project-based courses became boring with online instruction, because teachers couldn’t deliver them in the same way and reverted more to direct instruction, as described above.

The fourth big change was that a lot of teachers still tried to do some version of lab or hands-on activities to keep students more engaged and perhaps to include some of the Science and Engineering Practices in their teaching (Table 16). Teachers showed demos from their kitchen, they did virtual labs suchs as Gizmos, and tried to use PhET simulations to engage and educate students in the challenging times. Mike recalls, “I tried to do a lab. That was horrible, I had it all set on my kitchen counter….just classic middle-school ish kind of lab. And every two minutes, I would read off the thermometer of each of the samples, and then they would log it into their lab sheet...”

Even though we saw some glimpse of it already, it is worth highlighting again that most teachers felt that online teaching was exhausting and time consuming, especially the ones for whom the emotional impact on students was not too high, and they could still teach (e.g., the non-high-need teachers). Amy and Adam, who were teaching pretty much on a regular school schedule, mentioned that they felt really pushed and time restricted. As Adam shared, “So, I think one of the things that I found about online learning, compared to the normal method of face to face instruction, is that it was exhausting. And it was very time consuming.”
Lastly, the codes in dashed lines in Table 16 (mostly asynchronous and one-on-one meetings; one-on-one support for attending students, struggling learners, and special needs; teaching practices still figuring out) and Table 17 (attendance and engagement went down with time) again represent the similarity between Alissa and high-need schools, most likely because of the similar grading system. Alissa, much like the high-need schools, was teaching mostly asynchronously, and focused on providing more individualized feedback via one-on-one meetings. She could differentiate assignments and provide more individualized opportunities to meet the interest of those students who were showing up. This is good news for her and high-need school teachers as research shows that more individualized customized feedback, as opposed to collective or generic feedback to the entire class, leaves students feeling more satisfied with a course (Gallien & Oomen-Early, 2008). However, it is important to remember, most of the students were not even engaging with our teachers in this category who could provide one-on-one support. Much like the high-need schools, Alissa’s students' attendance and engagement went downhill with time and she was also not very happy with her teaching practices. This shows the choice of grading system did have an impact on student engagement and participation, irrespective of the socioeconomic status of the students.

However, it must be noted that Alissa’s expectations were similar to those of high-need school teachers only for her lower-level students. For her AP and Honors classes, her expectations and rigor hadn’t changed much. In her words, “For my AP class, my expectations for learning outcomes did not change much...for my Honors class, I kind of shifted...wanting them to have an experience, and some exposure and some practice with all of the topics...and then for my lowest level class...so we cut way down.” This is not surprising because teachers usually have differentiated expectations for students in low and high streams, informing their decisions about curriculum, pace, and pedagogy (Dulfer, 2015; Johnston & Wildy, 2018).
Theme 4: Factors Outside of Classroom

If there is one word that describes the experience of secondary science teachers in Maine with the process of teaching and assessment, it is “challenging.” Teaching remotely was extremely difficult for most teachers, and as Adam and Mia described it, “felt like the first year of teaching.” From the very introduction, the coder noted that teachers mentioned some challenges or the other. It is beyond the scope of this study to mention all the challenges that teachers talked about, however, but some of the more common challenges are described in this section.

For this theme and next, a different structure to present the data is followed. The codes that were common between all three categories of schools, shared by at least one teacher in each category, will be described as common challenges. If a code was shared by more than one teacher in only a single category of schools (e.g., only affluent, or only high-need), it will be mentioned in the compare and contrast table for high-need vs affluent schools. Thus, a code needs to have at least a frequency of 3 to be mentioned in general challenges (one from each affluent, middle-level, and high-need), and a frequency of 2, to be included in the comparison table between Affluent and High-need school teachers.

When going through all the 8 questions so far, teachers were asked about their priorities and expectations, their assessment and teaching practices, and the impact on their students and how they handled equity. Also, the research team was interested in understanding if there were other factors like parents, administrators, or personal factors that could have contributed to teachers' answers for all the previous questions. Some of these points about parents, administration, or personal factors were already mentioned by some teachers, while others talked about this more explicitly when asked:

(Q9.) What were some other CHALLENGES (in terms of parents, administration or personal) in assessment that you faced as an instructor?

As with other questions, teachers answered this question more so in general terms rather than specific to assessment. These non-classroom related challenges they discussed are divided into two big
categories: external and internal. First, external challenges related to administration and parents, and second, any internal (personal) challenges that teachers had.

EXTERNAL CHALLENGES

Parent Related Challenges:

- Affluent and middle-level schools mostly felt supported from parents and administrators whereas high-need schools mostly felt challenged.

Overall, the feedback from parents for teachers was mixed. Some teachers said that parents were supportive (Mike), while others said they were supportive for the most part (Amy, Adam, Alissa). Some said they got mixed feedback—i.e. both positive and negative—from the parents (Mia, Hank, Hazel). Others said that parents were not supportive, impatient with grades, and guessed that their lack of knowledge with online study systems made them stressed and so they checked out (Myra, Henry, Hope).

Mike did not face any challenges with parents. One possible reason could be that he communicated very well with parents on a regular basis. He shared, “parent wise, I didn’t have any. And I think part of it is because every Sunday night, I send out a letter (email). I said, here is what we are doing. I tried to make it very, very simple, you know, streamline. I used color where it should be, I used capitalization like old things so like I made I tried to make that very clear. And so I think because I communicated, it prevented parent backlash. I mean, how are you going to be mad at me if I’m telling you how to support your kid in what to do this week.”

On the other extreme, Myra, Henry, and Hope did not feel supported. Hope shared, “Challenge for some of my parents was getting to buy in that, you know, this was serious, and we really needed you to support us to have your kids do the work or parents who didn’t have them (students) do anything, and the day before grade close realized that, oh my child was failing before school was out. So, I want them to get
all their work done today. And then the work was just submitted with nothing on it...so we had some parents who were difficult to work with.”

The role of parents in the online education world cannot be understated. Especially during the early phases of COVID-19, when teachers and schools were still learning how to teach and assess online, the role (and impact) of parents was more important than ever before. As Mia shared, “I think parents took the role of the homeschool teachers. And I, we really were thinking more about working with, like, becoming administrators to multiple home schools, rather than, you know, working with individual students.” Students from affluent communities were mostly supported by their parents and that helped teachers to communicate and work effectively with these students whereas students from lower-socioeconomic backgrounds (in high-need schools) did not get the support they needed from home.

**Administration Related Challenges:**

Some teachers felt happy and satisfied with the support they got from their administrators (Amy, Adam, Alissa, Mike, Myra, Hank), while others felt there was a lack of guidance from the administration side (Henry, Hazel, Hope). Mia did not mention anything explicit.

Adam, who felt supported by the administration, shared, “The first thing I would say in thinking about this question (Q9.) is how grateful I was to have an administration that was as supportive, and how well our administration did, in my opinion, did a superb job at getting us through this difficult transition, we literally were given one day of training in distance learning and then the next day we started class. And our admin understood that, they provided us with what we needed in terms of support to get through that.”

In contrast, Hank did not feel as supported, saying, “And then I would say some of the challenges were, well, the administration was not overly clear as to what I was expected to do. Um, which I understand, I guess, I’m more understanding now. But at the time, I was going well, I don’t know what
you want me to do." Table 19 summarizes the challenges faced by affluent and high-need school teachers regarding both parents and administrators.

Table 19. Summary and comparison of external factors for affluent vs high-need school teachers.

<table>
<thead>
<tr>
<th>Affluent School Teachers Challenges</th>
<th>High-need School Teachers Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Admin was supportive.</td>
<td>• Lack of guidance from school admin.</td>
</tr>
<tr>
<td>• Parents were invested and supportive for most part.</td>
<td>• Lack of support from parents.</td>
</tr>
<tr>
<td></td>
<td>• Database of parents was not updated.</td>
</tr>
</tbody>
</table>

Affluent schools were more supported by parents and administrators compared to high-need schools, who were mostly challenged. This connects well with why it was more difficult for teachers in high-need schools to teach and assess and all the various challenges that they were facing, such as students’ lack of involvement, etc.

**INTERNAL CHALLENGES**

**Personal Challenges:**

In addition to the previously discussed challenges regarding teaching, assessment, students, parents, and administration, teachers also faced personal challenges. Some of them were shared among teachers in all categories while others were more unique to their category of school.

In general,

- Teachers in all categories felt a sense of resentment and unhappiness and felt they could not do a good enough job.
- At least one teacher in each category felt an internal conflict with their grading system and were not happy with it.
- Not being able to do the familiar assessment and teaching practices was hard.
- Teachers were burned out in the beginning.
- Teachers felt isolated, and not having colleague to colleague interactions was hard.
• Working from home was a challenge and having the same routine everyday was difficult.
• Exhaustion and physical health suffered.
• Family responsibility at home added additional stress.
• Non-academic exciting things (family trip, track events) got canceled which made things hard.

The following items were unique to Affluent and High-need schools.

Table 20. Personal challenges of affluent vs high-need teachers.

<table>
<thead>
<tr>
<th>Affluent School Teachers Personal Challenges</th>
<th>High-need School Teachers Personal Challenges</th>
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<tbody>
<tr>
<td>• Ethical concerns with cheating.</td>
<td>• Some students were completely off the radar. It bothered them a lot.</td>
</tr>
<tr>
<td>• Screen Exhaustion due to synchronous classes.</td>
<td>• Not so ideal home environment or personal space to work remotely.</td>
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</table>

Apart from these personal challenges, there were a lot of challenges that were unique to individual teachers and important to this study. Amy felt that she emotionally neglected her children for her students during these 4 months, and she powered through this phase in a very non sustainable way. Adam experienced a lot of course related challenges (physics) and felt it was harder than usual to teach his subject online. He also had additional challenges regarding his international students and the fear of some of them not being able to return from their home country after the summer because of lockdown and remote learning. Alissa struggled with not pushing her students for mastery as she used to and just helping everyone to get to a pass.

Mike was very bothered that some of his students were completely off the radar. Mia felt these times were very uncertain, and not knowing whether instruction would stay remote or go back in person throughout these times was stressful. Myra, who like Hope was a middle-school teacher, had a lot of middle-school specific challenges such as students not good with accountability, independent work and communication with text (discussed in Chapter 5 as a minor theme). Most communication was via text.
during these times, and research shows that misinterpretation of text (which is more likely to happen with middle-school young students) can negatively affect self-esteem (Nicol & Milligan, 2006; Rovai, 2003).

Henry felt that his peer teachers were not doing anything, and this reduced his expectation and what he was doing for the students. Hank said not being able to see where his students were at (assessment wise) was very difficult for him. Hazel mentioned that she was the only science teacher at her school and this made things more challenging for her. Moreover, she also had a child with special needs. Lastly, Hope shared that 40% of her students had accommodations, so her challenges were highly amplified as we saw that special-need students needed extra help and support during these times.

Thus, all teachers were extremely challenged. However, in the face of all these challenges, they persevered. They did the best they could and completed the school year.

Theme 5: Lesson Learned and Vision For the Future

After talking about teachers priorities and expectations (Q.1 and 2), their shift in assessment and teaching practices (Q. 3-6), the impact on their students and equity issues (Q. 7 and 8), and what other challenges they faced (Q9.), the interview was steered in a positive direction with the next three questions. The interviewer asked teachers about some successful strategies, lessons for future lesson design, and positives of this whole experience for them. As Alissa mentioned, “for the future it was important to design things differently rather than just cut it down.” All answers that teachers shared are presented here as a list and divided into successful strategies, positives, and visions for the future with the name of the teachers at the end who shared that code. The ones that were more popular have been highlighted. The list is included here for completeness for implication purposes, and a deeper analysis of each item is beyond the scope of this study.
Following three questions were asked from teachers to elicit response for what their strategies used, positives, and vision for the future.

(Q10.) What were some SUCCESSFUL STRATEGIES that helped you to overcome personal and professional challenges with assessment?

(Q11.) What do you think you have learned from these experiences that might play a role in your design of FUTURE assessments?

(Q12.) What have been some POSITIVE(S) experiences during this whole experience?

### SUCCESSFUL STRATEGIES & LESSONS

- **Reducing expectations and letting go.** [Amy, Adam, Alissa, Mike, Mia, Hazel]
- **Collaboration with colleagues and staff to support each other.** [Alissa, Myra, Henry, Hank, Hazel, Hope]
- **Realizing the essential pieces of existing assessment to streamline it. Hoping to do the same in the future.** [Amy, Alissa, Mike, Henry]
- **Grading system adopted by the school district was helpful.** [Alissa, Mike, Mia, Hank]
- **Keeping the structure and format of classes consistent for students.** [Adam, Mike, Mia, Myra]
- Realizing the importance of routine and engagement pieces. [Amy, Mike, Mia]
- Being already familiar with Google Classrooms. [Alissa, Henry, Hazel]
- Becoming more creative and open-minded about lessons and assessment. Hoping to continue it in the future too. [Amy, Adam, Myra]
- Connected the life science high school classes to the COVID-19 situation as students’ interest was peaked to know about the virus. [Amy, Alissa, Hazel]
- Support from the guidance counselor. [Amy, Alissa, Myra]
- Having a routine at home. [Adam, Mike]
- Anticipated the lockdown and had some materials prepared. [Alissa, Henry]
• Using online resources such as Khan Academy. [Amy, Henry]
• Learning the Zoom poll, chat feature, and breakout rooms with Google Doc to do formative assessment. Also, being more flexible with assessment. In addition, outside of school conversations helped and non-graded optional assignments had more participation than usual. [Amy]
• Helpful to have both synchronous and asynchronous materials for students. Also, having a small personal studio to record lectures was useful. [Adam]
• Students appreciated activities that did not involve looking at a screen. [Alissa]
• Worked with parents and ed-tech directly to support special-needs students. The first two weeks relaxed, helped him to get to capacity. [Mike]
• Used humor as a strategy. Also, having a strong mindset that “we can do this!” [Hank]
• Not worrying about grades was helpful. [Hazel]

Thus, in terms of successful strategies, the most popular ones were reducing expectations & letting go, and collaborating with colleagues and staff (happened more at high-need schools). In addition, teachers also realized the essential pieces of their assessments, and how streamlining it was helpful. They hope to continue to do this with their future assessments as well. Moreover, keeping the course structure and format consistent for students was helpful. Lastly, some teachers felt that the grading system adopted by their district was a successful strategy in itself. It is worth noting that Alissa, an affluent school teacher with a Pass/Incomplete grading system, mentioned four of these five most popular successful strategies.

POSITIVES

• Being able to try new, fun things in teaching. [Amy, Alissa, Myra, Henry, Hank, Hazel, Hope.]
• Admin was supportive. [Amy, Adam, Alissa, Mike, Myra, Hank]
• **Parents were invested and supportive.** [Amy, Adam, Alissa, Mike]

• **Learning the tools and technology for online instruction.** [Amy, Mia, Myra, Hank]

• **Knowing the kids in advance (as lockdown happened in the middle of the semester) was helpful.** [Adam, Mike, Hank, Hazel]

• A personal shift in perspective on teaching and assessment. [Amy, Mia]

• Got to know some students more because of more one-on-one interactions. [Hank, Hazel]

• More family time due to being at home and lockdown. [Adam, Mike]

• Learned the importance of student autonomy in terms of having choices. [Amy, Alissa]

• Being able to switch online and use Google Quizzes and other sources was good. [Amy, Mike]

• Grateful for being able to do online staff meetings. Also, she found it easy to give feedback on online assessments, and became aware of her own learning curve with assessment. [Amy]

• Happy about how school handled things and felt satisfied to get through this year. Also, he was grateful for a good and understanding home environment and loved the 4 day work week. [Adam]

• Having a rapport with students about cheating and ethical issues before the lockdown was useful. Also, students had the textbook from before, happy accident, and that was very useful. [Mike]

• Students taught teachers new things during the remote learning. [Mia]

• Enjoyed the degree of freedom (with art and design) that came while making online study material for students, and also appreciated the flexible schedule of working from home and getting random things around the house done with extra time. [Henry]

• Enjoyed having less workload and some free time on hand due to Pass-Fail. [Hank]

• Some students learned more about their learning style by having more one-on-one time. [Hazel]

In terms of positives, the most common sentiment among many teachers was that they were grateful to have the opportunity to try new things. Non high-need teachers were also grateful for parents and administrators support. And some teachers expressed gratitude for learning new technology through
this experience. Lastly, some teachers were grateful that while going in this sudden remote learning, they had some idea of who their students were from classes that had happened till closure, which helped in supporting their students.

VISIONS FOR THE FUTURE

- **Hoping for more synchronous teaching.** [Alissa, Myra, Hope, Hank, Hazel, Hope]
- **Figuring out alternate ways to do more interactive, activity based and hand-on learning.** [Adam, Mia, Myra, Hank, Hope]
- **Home-lab/Lab-in-a-bag idea for future.** [Adam, Alissa, Mia, Myra]
- **Plans to use Google Classroom in future, even for regular classes.** [Amy, Mia, Hank, Hope]
- Thinking about using more flip classroom style. [Amy, Adam]
- Find more alternate ways to assess than just writing. [Myra, Hope]
- Hoping to use Breakout Rooms in the future. [Hank, Hazel]
- Create more opportunities for students to have independent and self-paced learning opportunities. Thus, more equipped to help students who miss classes for inevitable reasons. [Amy, Henry]
- Looking forward to tackling the challenge of dealing with fresh students, as in Spring 2020, teachers had some understanding of their students before they went remote. [Adam, Hank]
- Realized that things need to be set up in advance for success in online learning. And hoping to use the social-emotional learning knowledge that was gained. [Amy]
- Hoping to “keep the camera on” policy (Zoom invented filter feature soon after to protect background privacy). Also, planning to reach out to teachers in other schools and see what worked for them. Moreover, planning to bring more peer-peer learning for students. In addition, find ways to make students feel safe, by using light humor, to increase their participation. Lastly, thinking about cheating concerns. [Adam]
- Planning to use more external sources for teaching and assessment, and also feeling more confident to make bigger shifts in assessment design for students. [Alissa]
- Hoping to collaborate with colleagues more. [Mike]
- Field-based or project-based learning might be an alternative way. Also, more willing to include technology in the future in the classroom. [Mia]
- Figuring out a way to get more informal formative assessment data while teaching. [Myra]
- The kids who did well in the new environment unexpectedly (see emergent themes), hoping to figure out a way to continue that. [Hope]

Six out of eight teachers who had asynchronous classes expressed somewhere during the interview that they wish to have more synchronous meetings with their students in the future. Lot of teachers plan to use some sort of active-learning, hands-on, and lab activities. Google Classroom will continue to be a part of classroom management for some teachers.
Emergent Findings

The original plan of this research study was to target and understand how secondary science teachers in Maine experienced the process of assessment during the COVID-19 lockdown. All the questions were designed to understand this probing question. However, the nature of these interviews was conversational and teachers talked frequently about teaching, as much if not more than assessment. So, the research questions were modified accordingly. The first initial analysis rounds showed five overall themes that have been discussed above. These five themes – impact on students and equity issue, priorities and expectations, teaching and assessment practices with challenges, factors outside of classroom, and lesson learned & vision for the future – came out of the targeted questions that explicitly focused on these topics.

In addition, there were other short findings that appeared, which were not a part of the original set of research questions. While having conversations through the 13 interview questions, teachers also talked in detail about the following topics:

1. Emotional support for students at high-need schools.
2. Crosscutting concepts are not assessed as frequently in the regular classrooms.
3. Impact of the grading system.
5. Some struggling learners blossomed in remote learning.
6. Extra struggle of special needs students during remote learning.
7. Middle school specific challenges.

These emergent findings discovered more or less sequentially, i.e. when talking about priorities and expectations (Q.1 and 2), how high need schools provide the extra support for their students other than academics appeared. When talking through NGSS three-dimensional assessment question (Q.4), the cross-cutting finding showed up. Next, when talking about assessment and teaching practices (Q.3–6) minor themes about the impact of the grading system and DOI appeared. When talking through impact on
students (Q7.) findings about some struggling learners who unexpectedly did well, and struggles of special need students showed up. Lastly, while talking through challenges, the middle school specific student challenge theme appeared. It is important to note that excerpts and codes from all over the interview data are used to make sense of these emergent findings and not just the questions where they initially came into light. In this chapter, I describe each one of these themes and see what implications they might have for future educational research.

1. Emotional Support for Students at High-need Schools

While having the conversation with high-need school teachers–Henry, Hank, Hazel, and Hope–and talking about their priorities and challenges during the remote instruction, it was seen that most students at these schools get a lot of emotional support that they otherwise perhaps don’t get from their home environment. These students coming from low-socioeconomic backgrounds often have challenging household situations and not so ideal environments at home for education.

Hope, when asked how her students were impacted due to the lockdown mentioned, “Emotionally, the first month I literally was talking to either students or parents from 6 am to 9 pm, either via email or phone calls. The emotional needs of their families were so high.” About students' study environment she shared, “study environment, you know, there are 4 or 5 kids in the house, they are all fighting for space at the same time.” Regarding family issues, she said, “Family issue, a lot of my kids live in really, really rough houses. And I’m assuming that things were not good for them. Lots of drugs, lots of arrests, lots of abuse going on. And I know it was worse because I’ve got friends who work in the court system, and you know, you hear the sirens going.”

She also mentioned later in the interview “You know, a lot of the kids, they don’t have support from their parents at home. And the only place they get that emotional support is at school. And we have, you know, many of them that have latched on to various people in the building.”
Thus, teachers and staff in these high-need schools work extra hard to provide that emotional support to these students. As we saw in the Maslow’s hierarchical need pyramid, and its educational analogue (Milheim, 2012) as discussed in chapter 2, it is important for an students to have a stress free environment, a safe space for study, and to feel they belong to the learners’ community (Level 1: physiological need, Level 2: Safety, Level 3: Relationships) to achieve a better self-esteem (Level 4) and self-actualization (Level 5), which is the ultimate goal of schooling and education.

Therefore, in the absence of these needs being met at home for students coming from low-socioeconomic backgrounds, school becomes the place for them to get these needs met. If we really care about our students in these schools, we have to meet these fundamental needs first, before we can start to make a difference in their self-esteem and intrinsic learning motivation. This was a big concern and fear among high-need school teachers that their students' needs were not being met during the remote instruction.

Hank, another high-need teacher shared, “When you have that contact (in regular class) with the kids, and you’re able to build a relationship with the kids, that certainly helps. You know, and that’s one thing we really focus on....and that was what our biggest concern was, was losing those connections, as the kids were away from us.”

This finding has implications for teachers working in high-need schools who are working with students who come from low socio-economic families or minority backgrounds (ethnical, racial, cultural, etc.) that they need to provide the basic emotional support to their students, make them feel safe, and that they belong, before any true skill development can happen. This relationship driven approach is in line with some popular cinema about teaching students at risk as well. For example, in the movie Freedom Writers (LaGravenese, 2007) the teacher, Miss G, who is trying to teach at-risk teenagers in a racially divided school in LA, California, adopts a similar approach. She builds a connection with these students first, and then slowly with care and effort turns their life around. It is worth noting that this movie was based on the real story of English teacher Erin Gruwell.
In conclusion, it is important to acknowledge that teachers in high-need schools work hard to provide emotional support to their students as they try to teach their lesson plans. So, even though the scores of these schools might be average, the amount of work that teachers do in these schools to get these students to these levels is commendable.

2. Crosscutting Concepts Not Assessed Frequently

In 2013, the adoption of Next Generation Science Standards (NGSS) marked the beginning of a new and unconventional way to teach science through three-dimensional learning in the classroom. Instead of being just content driven, standards emphasized skill development through a three-dimensional teaching of science: Disciplinary Core Ideas (DCI), Crosscutting Concepts (CCCs), and Science and Engineering Practices (SEPs). It is not just enough to teach the three dimensions, it is also important to assess in three dimensions. Researchers were interested in understanding how the assessment of three NGSS dimensions were affected when we went remote (in Q.3).

In the interviews and data analysis, it was seen that most teachers talked a lot about practices (and how it was hard to do them), however, the crosscutting concepts or their seven components (pattern; cause and effect; scale, proportion and quantity; system and system models; energy and matter; structure and function; stability and change) were not discussed by most teachers. Six out of ten teachers did not make any comment on it. Of the four who did, two of them admitted that they don’t assess it intentionally.

Amy, an affluent school teacher, admitted when asked to comment anything about crosscutting concepts, “Yeah, I don’t think, I think of like, I don’t think I have that intentionally assessed. Let me think. Yeah, I don’t think that, I definitely didn’t consciously think of ways to assess that differently in the online setting.”
Henry, a high-needs teacher, also shared, “And I will just say that, in general, I do not focus much on the crosscutting concepts before or after remote instruction. I think, I use the content standards to inform me and then I make sure they apply and are clearly applicable to SEPs.”

This highlights the fact that we need more professional development and support to help teachers become more familiar with what truly crosscutting concepts are and how to teach and assess them more intentionally in the classroom. It is definitely not as straightforward as DCI or SEPs.

3. Impact of the Grading System

In March 2020, when the Coronavirus pandemic was at its peak, all the schools were shut down and went remote. How the new ‘online schools’ were taught and assessed during these remote times was a mandate that came down from the school district (or administration, if private). Different school districts (and private schools) in Maine adopted different kinds of grading systems, based on various factors. All schools had realized that this was no ordinary time. They realized that students and parents were locked at home and stressed about the growing spread of the virus. As discussed in Theme 3, there were many factors involved in changing the grading system: emotional stress of students, lower attendance, declining engagement, lower instruction and interactional time between teachers and students, and low authenticity of online testing. Thus, most schools changed their grading system (except Amy and Adam).

It is worth noting one reason Amy and Adam’s schools didn’t change their grading system. Data suggests it was because parents at these affluent schools were invested and concerned for their children's learning and future. They didn’t want their kids’ learning experience and college dreams to be compromised. As Amy shared, when asked how she felt about keeping the grading system the same when so many schools changed it, “I teach at a private school and there was a lot of parental pressure not to, a lot of parental pressure to keep grades, we want colleges to see that our students are still learning.”
Also, Alissa, the third affluent school teacher in our study and the only one whose school had changed the grading system to Pass/Incomplete, also mentioned that she received some pushback from parents because of the change. She recalled, “I got some pushback from parents that were concerned that their students would not be motivated to work for 70 (Pass), they’re just going to get a Pass, they need to be able to work for that 90 or A or whatever that is that they work for. So, there were some parents that were not satisfied with that decision once it was made. And so that was challenging.”

She also had an episode where a parent was concerned about her child getting an “Incomplete” on their transcripts. Alissa shared, “she (parent) was just concerned that it (an Incomplete) was going to look bad on college transcripts. But once she knew that, in the end, that pass was going to look like a pass, it wasn’t going to be like with an asterisk that says, you know, after failing and then going to summer school, and also reminding her that the entire world knows that we’re going through this…once she had the context, everything was fine.”

These results support the claim even more that parents in affluent schools are more invested in their children's education relatively than at high-need schools (as we saw in the minor theme 1).

For the eight schools who did change their grading system, they mostly went from alpha-numeric grades to a simpler and equitable system of getting a “Pass, Incomplete or Fail” (or some combination of these) as their grades or “Do No Harm.” In DNH, students’ original grade (before remote learning) cannot be lowered, but could be improved. Thus, as Henry shared, “if a student had an A, when we left, and they did nothing, they still got an A at the end of the school year. It didn’t matter what we did.” And one can only fail in this system, if they were already failing and they did nothing when school went remote.

An interesting result that came out of the analysis was that the impact on teachers and their teaching and assessment practices, and even their satisfaction level with the overall remote learning were affected by the grading system that their school had adopted. It is important at this point to show (bringing Table 13 here again) all the different grading systems that school had adopted which ranged from Mike, who had the broadest possibilities (see Table 13 and discussion below), to Mia and Myra who
had three options, to Alissa and Hank who had two, to finally Henry, Hazel, and Hope, who were do Do No Harm.

Table 13: The new grading system for all our participants.

<table>
<thead>
<tr>
<th>NEW GRADING SYSTEM</th>
<th>TEACHER NAME</th>
<th>SCHOOL CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change in grading system</td>
<td>Amy</td>
<td>Affluent</td>
</tr>
<tr>
<td>No change in grading system</td>
<td>Adam</td>
<td>Affluent</td>
</tr>
<tr>
<td>Number Score/Pass with Remediation/Fail</td>
<td>Mike</td>
<td>middle-level</td>
</tr>
<tr>
<td>Pass with distinction/Pass/Fail</td>
<td>Mia</td>
<td>middle-level</td>
</tr>
<tr>
<td>Pass/Incomplete/Fail</td>
<td>Myra</td>
<td>middle-level</td>
</tr>
<tr>
<td>Pass/Incomplete</td>
<td>Alissa</td>
<td>Affluent</td>
</tr>
<tr>
<td>Pass/Fail</td>
<td>Hank</td>
<td>High-need</td>
</tr>
<tr>
<td>Do No Harm (DNH)</td>
<td>Henry</td>
<td>High-need</td>
</tr>
<tr>
<td>Do No Harm (DNH)</td>
<td>Hazel</td>
<td>High-need</td>
</tr>
<tr>
<td>Do No Harm (DNH)</td>
<td>Hope</td>
<td>High-need</td>
</tr>
</tbody>
</table>

Mike’s school district instituted a policy where he did numerical grading to most of his students who were involved, then his school did Pass with Remediation/Fail for the ones that needed special accommodation who were not able to engage with school, for valid reasons or by choice. So, his school district had normal grades for most students and a Pass/Fail version for others. Mike shared,

“Administration of our school was amazing. Like, absolutely amazing. Windtown (name changed) did it right. They sat back and watched what some other schools did. And they took their time. And when they launched, what they needed to launch (grading system), they did what they said they were going to launch. We didn't do a lot of pulling back because of a new issue or something like that. So very impressed.”

He also added, “So, I would say over 90% of my students got a numeric grade…but other ones I had, I had a few students who failed all year and they will need to retake…and then I had a small list of students probably three or four that were in that pass fail category that we just discussed, so they will
have an opportunity to remediate what they missed.” The University of Maine, which is the biggest university in the state of Maine, also adopted a similar structure, where the choice was given to the students if they wanted a regular alphabetic grade or just go Pass/Fail during the same time.

Mia, a middle-level school teacher, whose school did Pass with Distinction/Pass/Fail also seemed satisfied and happy with the system. When asked how she felt about the change in grading system, she said, “I think it was absolutely the right decision for the situation. I was very much in favor of it.” Whereas Myra, whose school had adopted Pass/Incomplete/Fail (She called it Complete/Not Enough/Not Engaged) was not relatively as happy and felt some challenges. She mentioned, “we had very loosey goosey kind of expectations. And our grading was like, you got it or you don’t. And we didn’t do much reporting around it… it was hard for me to shift, okay we have grades, and we are gonna do this, you know, what we normally do in school, and then all of a sudden, we’re not going to report as much.”

However, it is important to note that she had some additional challenges because of teaching Middle School students, we will see this in the seven emergent findings. Another interesting point to note is that Mia’s school cared more for motivated learners (Pass with Distinction) whereas Myra’s cared more for struggling students (Not Enough and Not Engaged).

Alissa and Hank who had Pass/Incomplete and Pass/Fail respectively, had some challenges with attendance and engagement. However, they both seem to be okay with what their district did. Hank shared, “that was an admin decision to go Pass/Fail. It was okay… one of the reasons we did it that way, because everybody was in a huge period of adjustment.”

It is worth noting here though, that even though there were binary grades for students at these schools, Pass being common, the affluent school chose Incomplete as the second option whereas the high-need school chose Fail. Again, showing the approach and mindset difference in decision making at these two districts. There is no data to make any claims about why these differences exist, but it is worth acknowledging them here and perhaps another study could examine it.
Lastly, all the high-need school teachers whose district went Do No Harm—Henry, Hazel, and Hope—had perhaps the most challenges and did not feel very satisfied with the whole process of teaching online. The biggest impact was on student attendance, and that demotivated these teachers a lot. As Hope shared, “At that point, I believe it was made public, that we were going to be Do No Harm, for that period of time. So, we had a lot of kids who checked out and weren’t participating at all, because they figured all on passing, it doesn’t matter, I don’t need to do it. And they had permission from their parents to do that, so that kind of made it hard.” Also, reinforcing about the missing role of parents as we learned in minor theme 1.

Moreover, they all had to reduce down the rigor for students who were still engaging to get a Pass as the ones who had a passing score before the lockdown were going to Pass without any work, so it felt just to be easy on the ones who were still engaging and working to turn stuff in. As Hazel shared, “if you did an assignment, you got 100. That’s what you got for an average at the end of the quarter. So, my expectations had to shift significantly, because I really didn’t think it was fair for those that were working hard, and trying to get the assignments in to have lower grades...”

In conclusion, there is strong correlation between the grading system the school adopted and how that impacted teachers and the challenges that teachers faced in remote learning. Mike’s answers suggest that his school did it the best, followed by Mia. Amy and Adam, even though they struggled with teaching and cheating issues, were still able to hold classes and teach and assess in a regular manner. Myra had her challenges too but still not as much as the ones who went Do No Harm, i.e. Henry, Hazel, and Hope. They struggled the most because of student decline in engagement & attendance, and reducing the expectations a lot for those who were still doing work to be more fair and equitable.
4. Differentiation of Instruction (DOI) during COVID-19 Remote Learning

Even though not a part of the original research study explicitly, teachers talked about differentiation of instruction (DOI) in the interviews. It came up naturally while talking about their teaching practices. For some teachers who were interviewed later, the interviewer explicitly asked it as a follow-up question (in Question 5 about Teaching Practices) after noticing that it came up naturally for some teachers earlier. The question we are trying to address in this section is “how was differentiation of instruction affected during the remote instruction teaching phase?” Our analysis reveals three important results about DOI.

First, some elements of it became easier, especially for teachers who were teaching asynchronously. For the first time, they were not lecturing regularly every day, and had more time to look at student work and provide individual feedback on their assignments. As Mia said, “I think we shifted into a more holistic approach. And, you know, definitely a more creative learning, individualized sort of opportunities, and the remote learning definitely lends itself off to some of that kind of more individual instruction.” She also said, “I think its (DOI) easier. And I think, when we are planning our next year, we are less concerned about leveling and more we are thinking more about grouping based on topics and content-based rather than sort of ability.”

Second, it was extremely difficult to do any DOI during the instruction during online classes. On Zoom, during synchronous meetings, it was hard for teachers to even gauge where their students were at, due to the lack of informal data that they otherwise collect through facial expressions, body language, and just being in the same space as students. Amy, who was teaching synchronously, shared, “So, I felt like differentiation is something I had a better handle of in the regular classroom setting. And completely almost ignored it with just like teaching to a screen in the beginning. And then I was, I don’t know if this is as much differentiation as one on one teaching office hours, I felt like that’s what it came down to…”

Thus, some elements of DOI became easier for teachers who had more time to give one-on-one feedback because they were teaching asynchronously, whereas some elements of it became hard as
described by the teachers who were teaching regular classes during these times. These findings are in line with Tyrinna’s work on differentiation for Maine secondary science teachers (Tyrinna, 2021).

The third and last interesting finding on this topic was that some teachers did differentiation in terms of providing more choices to students to succeed. Alissa mentioned, “I build a differentiating assessment in my class anyway. This was different than that because when students got the 70 (pass), nobody was going to work to get a 90 because a Pass is a Pass. So, my shift to differentiating instruction was more focused towards the like, getting somebody from a zero to a pass (by offering choices), rather than kind of shifting everybody up.” She also shared, “everybody had all the opportunities to get that pass, as many as they needed. And if, they didn’t do the first thing or the first thing went badly, we were required to give them another opportunity...many of my students completed different assessments than other students...it really opened up the door to make assessment be whatever was going to work for each kid.”

Moreover, Amy also shared that by doing so, she realized the importance of student-autonomy and its positive impact. She said, “So student-choice is a strategy that I will keep going forward, more flexibility, more opportunity for students to show success...I had been learning about, the role of assessment, when assessment is done well, like, I think it was more obvious to me. So, if that was a challenge I had before, I think this has helped me to overcome that.” Hazel also shared in her interview that not worrying about grades helped her to differentiate better in terms of giving students more choices based on their interest to succeed.

In conclusion, differentiation of instruction was affected during the remote learning phase. Some elements of it, like individualized feedback, became easier due to teaching asynchronously whereas other elements of it became hard due to not getting informal data about students during synchronous online classes. Lastly, teachers also did a lot of differentiation in terms of providing more choices to students, and it seemed to have worked well for them and they hope to continue differentiation by choice. This is supported by literature about building more student-choices in lesson plans as we will see in Chapter 5.
5. Some Struggling Learners Blossomed in Remote Learning

As we saw in Chapter 4 (Theme1) an unexpected finding of this study is that two high-need teachers (Henry, Hope) and two middle-level teachers (Mike, Myra) mentioned that some of their struggling learners (in traditional classroom) blossomed when teaching went remote. As Mike said, “I had one student that had a hard time at school. And when we went to this (remote), she just blossomed. And there are stories of that within the school where there is a population of students that did so well, that normally do horribly in the classroom. That was one of the biggest, crazy aha that I had.”

This is an interesting result, especially in terms of Vygotsky’s sociocultural theory. Some learnings are potent in students and need an external aid to blossom (Vygotsky, 1978). It seems like the new online learning platform provided a space that is not available to some of the ‘struggling learners’ in a regular classroom.

When the interviewer asked Mike why he thought this unexpected change happened, he replied: “I believe, and this is just an inference, but I believe that it is taking the social distraction away from them, that allowed them to just do their work, busted out and move on.” This answer was similar to what other participants in the study had said when asked why this phenomenon happened in their classrooms.

This finding is crucial, and it highlights the fact that instead of changing the student, which is the usual approach to improving learning outcomes, we should also think about changing the environment and context in which the learning takes place, especially for our ‘struggling learners,’ who have shown potential. This is in line with the social constructivist theory which emphasizes the fact that learning is a social process. Perhaps, however, the kind of social interaction and engagement that some students need might be different from others to excel. This study calls for more research to find out why this happened and how we can continue to support these students who don’t do so well in the regular classroom, but have shown that they are extremely capable.

As Hope shared when talking about some of her positives, “I think the other one that I keep going back to is those few students that I have that struggle being in the classroom, how well they did at home, without all the stressors on them. They flourished, it worked out as a really good learning environment
for them. I don't know whether there is a thing that we could use, from this experience for them, I'm not sure. But it is going to stay with me, because you know, it really worked well for those kids, where, before they just, they struggled every day. So that was that was huge, and I wouldn’t have expected that.”

6. Extra Struggle of Special-need Students During Remote Learning

In 2001, the No Child Left Behind Act (NCLB) (Behind, 2002) was introduced in the US and one of its goals was to improve educational outcomes for disadvantaged students and close the achievement gap between various subgroups of students, including those with disabilities. One of the proposed ways to do it was by designing assessments and lessons that are accessible to the widest range of students, including students with special needs. However, during the COVID-19 remote instruction time, special need students struggled more than other students. The gap was amplified.

As mentioned in Theme 1, the impact on the students section, the effect of going remote during the lockdown was severe for students with special needs. Out of the ten teachers in this study, three (Adam, Alissa, and Mia) did not make any direct comment on this, six teachers (Amy, Myra, Henry, Hank, Hazel, and Hope) said that the support required for special needs students had increased. Mike was the only teacher who said that he was able to support special-needs students in his class via the help of ed-tech and parents (who he communicated directly with). For most teachers, their special needs students required extra support and care than usual because of the change in the platform from in-person to online, and it was relatively more challenging for them to get their special needs students involved. As Myra shared, “I already know that I worked double, I think she (special ed teacher) worked triple with, with all the follow up that she had to do. And then on top of that, you have got behavioral needs, for some of those kids who were just melting down. And I talked earlier about making that process, you know, even smaller, for those kids that (teaching process) had to roll back even more. And it was, I don’t know how much they got.”
This was not just a hard time for teachers who had students with learning disabilities, but also for parents of these students. Hazel, who also is a mother of a special needs student, shared, “My youngest is a 12-year-old. He is in sixth grade, he does have an IEP. So, there is some special ed going for him. And that was a whole other realm of just trying to keep him on track. He needed that extra support that I knew, that’s and I guess that’s why I realized how hard it was for other parents because I knew how hard I was having to work...so I have a lot of sympathy for what was going on with my parents because of my own situation.”

It is worth noting that all of the four high-need school teachers reported this challenge compared to other categories where either one (affluent) or two (middle-level) teachers shared this issue. In conclusion, this result has implications, as we go back to regular classrooms and hope to use some of the tools & technology that we picked from the remote instruction phase (such as Google Classroom), it is important to pay extra careful attention to help students with special needs to incorporate these changes.

7. Middle School Specific Challenges

Two of our ten participants were middle school teachers. Some things that they shared were deemed important and common between them. Even though every teacher was struggling to teach during the lockdown, there were some challenges unique to the two middle school teachers. Three things were common between the concerns mentioned by Myra and Hope regarding their students.

To begin, both the teachers reported that their middle school students struggled to do independent work during the lockdown. Remote learning and asynchronous teaching for Myra and Hope had required for them to introduce ample amounts of independent work for their students, and they found that their middle schoolers struggled, perhaps because of the young age group. As Myra mentioned, “I think high school has, like an advantage of those kids are maybe able to do more independent work...so I do think there’s an advantage to like you’re developmentally ready for, you know, more independence. And, you know, follow through the online piece.”
The second common sentiment that both Hope and Myra shared was that their middle school students struggled with accountability during remote instruction. Perhaps the Do No Harm at Hope’s school made this even more challenging.

Hope shared, “I don’t know, if it’s just this age, or whether there’s something else in there, where they’re just like, I don’t have to it, then I am not gonna do it…sixth and seventh graders a lot of times haven’t realized that learning is, it’s not a horrible thing. It’s something to enrich yourself. And it’s beneficial. And it’s not just about grades, it’s about growing, and going from there. I don’t think that has clicked in them yet.”

On the similar lines Myra also mentioned “There were so many missing assignments at one point, that I’m like I am putting it all in there, it is either 0, if it is not turned in at all or a 3, you have turned it in. And after I did that, I felt so much better. Because like all of a sudden, kids are like oh I got to turn it in. So, they were expecting us to hold the accountable…”

Third and last thing that both our middle school teachers struggled with (and realized) was that texts are not the best way to communicate or assess their students. It is generally hard to peak their students’ understanding through text. In light of Sociocultural Theory, their mental ‘schemas’ are not easily represented via texts (Piaget, 1955) perhaps because of the young age group. Both Hope and Myra struggled with this. Myra realized that she needs to do more oral assessment. She mentioned, “Whereas if they are talking or having a conversation in their lab group, it’s so much richer and so much more deep, and they aren’t getting that down on pencil and paper. And I am not sure if that means that I have them do recordings, um or something else, in addition to just typing their answers. I am not sure. But it’s definitely things to think about.” She also added, “I had to like rely a lot on like, I had individual sign up for, let’s do your assessment (on video call). And it’s so funny because they, they freak out a little bit, especially with the, you know, the technology this way. And then I’d ask them a series of questions, and they had it and they were like “that’s it?” And I am like, yeah, that’s it.”
On the similar lines, Hope is thinking about how to deal with this situation for the upcoming year when asked about her plans for the future assessment design (Q.11).

Hope mentioned, “My assessment can’t just be written, I really need to continue and expand other ways for the kids to let me know what they know, other than just the written word, it loses a lot in the translation”

To summarize, middle school teachers had unique challenges in addition to the challenges of remote learning described in Chapter 4 above. They realized their students struggle with independent work, accountability, and communication with text or writing. They hope to use these realizations to improve their future teaching and assessment.
CHAPTER 5
DISCUSSION

Summary and Discussion of Findings

Many findings were discussed in the above-mentioned 5 overall themes and 7 emergent findings (Chapter 4) and it is important to connect them together and with the literature to form a coherent understanding of results in this study. The table below summarizes the five themes and seven emergent findings.

Table 21. Summary of findings.

<table>
<thead>
<tr>
<th>5 THEMES</th>
<th>7 Emergent Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEME 1: Impact on students and equity</td>
<td>1. Emotional support for students at high-need schools.</td>
</tr>
<tr>
<td>THEME 2: Priorities and expectations</td>
<td>2. Crosscutting concepts are not assessed generally in the regular classrooms.</td>
</tr>
<tr>
<td>THEME 3: Assessment methods and teaching practices with their challenges</td>
<td>3. Impact of the grading system.</td>
</tr>
<tr>
<td>THEME 5: Lessons learned with vision for future</td>
<td>5. Some struggling learners blossomed in remote learning.</td>
</tr>
<tr>
<td></td>
<td>6. Extra struggle of special needs students during remote learning.</td>
</tr>
<tr>
<td></td>
<td>7. Middle school specific challenges.</td>
</tr>
</tbody>
</table>

Each of the themes and its implication are discussed here, and some emergent findings (1, 5, and 6) appear as part of Theme 1, while others (2, 3, 4, and 7) are part of Theme 3. As highlighted in Chapter 3, the emergent findings are inherently part of the overall five themes that have been explored in depth to highlight certain nuances in these themes.

IMPACTS ON STUDENTS AND EQUITY ISSUE

In general, as reported by our teachers, common impact on students were struggle with emotional health, lack of routine and structure, boredom, suitable study space, and not being able to receive
differentiated instruction. These findings about a small sample Maine schools are in line with the research that shows during the COVID-19 lockdown, the mental health of adolescent worsened, and social distancing and remote learning had increased the risk of future mental health issues (Clemens, 2020).

However, these impacts were more severe for students at high-need schools who struggled with severe emotional health issues (such as anxiety and stress), internet issues, technology accessibility, and poor study environment. Again, this is in agreement with research findings, showing that students in remote and disadvantaged areas faced internet issues, technology access, and harsh study environment (Alsoud, 2021). These findings about the struggle of disadvantaged community students are even true abroad, such as in India (Singh, 2020).

In comparison, the students at affluent schools were challenged with less severe emotional health issues (such as motivation and missing the social aspect of school) and finding quiet study space. The effect of lockdown and social isolation has been shown to affect student motivation (Birmingham, 2020) and social well-being in general (Solmi, 2022).

Thus, in terms of Maslow’s hierarchy of needs (Maslow, 1943) in an online education setting (Milheim, 2012), students in high-need schools struggled to meet the lower level needs of physiological well-being and safety, whereas students in affluent schools were challenged more with upper level needs of sense of community, and intrinsic motivation to do school work. It is also important to remember that parents were more involved for students at affluent schools compared to high-need ones, which further amplifies differences in impact on these students from the two kinds of schools.

Another finding of this study regarding students was that students at high-need schools have higher emotional needs in general due to poor home environment, and teachers in these schools spent a good part of their time and energy to provide these supports for their students.

In addition, this study shows that many teachers (from non-affluent schools) reported that some students who struggle in regular classroom settings, blossomed during the remote teaching perhaps due to
fewer social distractions. Some of these teachers were interested in understanding how to continue to support these students in regular classrooms as well.

Teachers, in general, have been concerned about teaching students with disabilities during COVID-19 lockdown (Catalano, 2021), and our study found that students with special needs were most severely impacted during the remote learning. As parents usually lack the professional expertise and rely on schools and therapists (Dalton et.al, 2020), the closure of schools adversely affected the support these students could get. As a future implication perhaps, some literature suggests that student choice is one of the best ways to help students with special needs (Servilio, 2009).

Given all the various impacts on their students, to be fair and equitable, teachers reduced their expectations, became more flexible, and made themselves available to provide support. They also mentioned that reducing expectations and letting-go was a successful strategy to deal with the challenges of remote teaching.

NEW PRIORITIES AND EXPECTATIONS OF TEACHERS

In the wake of the various perceived impacts on students during the COVID-19 remote instruction, teachers shifted their priorities from academics to health and safety of students, contacting them regularly, being available for them, and keeping them engaged. In addition to these four common priorities, high-need school teachers were concerned with high emotional needs of their students whereas affluent teachers were concerned with the social-emotional well-being of their students as mentioned in the above section.

Once the priorities shifted, the expectations for students' academic learning outcomes were reduced by all teachers. This was also a way for teachers in all schools to be more fair and equitable to their students, given the severity of impact. Again, high-need schools reduced their expectation much
more (to partial completion and effort) compared to affluent schools (to less content depth and focusing on exposure over mastery). These differences in teacher expectations make sense in the light of impact on students, parental involvement and support from administrators. High-need teachers had students who were severely impacted, and these teachers mostly did not get the support they needed from parents and administration.

Thus, teachers in affluent schools had relatively higher expectations for students' learning outcomes. Studies show that when teachers set high expectations, their students follow suit (Alvidrez & Weinstein, 1999; Weinstein, 2002, 2008). However, when teachers set low expectations for students, especially for the ones coming from already disadvantaged backgrounds, they can also follow suit and their learning outcomes are compromised (McKown & Weinstein, 2008; Rubie-Davis et al., 2006). Socio-economic status (SES) of students can influence teacher expectations (Alvidrez & Weinstein, 1999; Rubie-Davies et al, 2006). Findings suggest that teachers are likely to develop negative attitudes towards low-SES students in general (Auwaerter & Aruguete, 2008; Sorhangen, 2013). These findings have been consistent even abroad, for example in Chile (Barriga et al., 2019).

It is important for teachers in all schools to have higher expectations for their students, though for valid reasons it is more difficult for schools with low-SES students. Interventions designed to raise teacher expectations have seen some success in improving student academic outcomes. Studies have also shown that high teacher expectations are beneficial for improving the educational outcomes of minority groups, such as Aboriginal students (Hurst & Sparrow, 2010) in Australia. Another good example of a school system that turned things around with higher teacher expectations is the California CalPrep school (Reed & Cortez, 2016 chapter 13) through appropriate mediation and support from administration.

Lastly, some research also shows that there are ways to alter expectations, by adopting the practices of high expectation teachers such as goal setting, classroom climate, and flexible grouping (Rubie-Davis, 2007).
ASSESSMENT METHODS AND TEACHING PRACTICES

These changes in priorities, reduced expectations, shifts to online platforms, and new grading systems (or criteria), changed how assessment and teaching happened in the ten Maine schools that were a part of this study. In general, assessment became more streamlined and teaching rigor reduced. Classrooms became more driven by content rather than Science or Engineering Practices (SEPs).

Secondary science teachers struggled because of not being able to do informal formative assessments, and research shows that availability of helpful formative assessment is crucial for online learning (Doucet et al., 2020). Teachers were also challenged to find replacement for hands-on activities and active learning methods which was true for teachers across the globe during this time (Luburic, 2020). Pedagogically, teachers struggled to use familiar teaching methods (Shamir-Inbal & Blau, 2021) and most of them used new teaching methods (Johnson, 2020), which was true for teachers in this study as well. There was no group work, and teachers were challenged with learning new technology. Lastly, teachers did their best and tried new things in class to retain student engagement and attendance, which declined mostly with time.

Again, it is worth pointing out that there were significant differences between the high-need schools and affluent schools. Affluent teachers had more instructional time, they taught and assessed (leniently) more, and mostly struggled with cheating issues, differentiation of instruction during class, and not being able to cover material to the same depth and in different ways to make learning as engaging as in a regular classroom. Thus, learning was still expected but the rigor was lower than before for students at these schools.

In comparison, high-need schools did not do any formative assessments, engaged mostly in asynchronous teaching through assignments, and provided one-on-one support for students. Also, they did not do any summative tests or quizzes, and the bar to pass was very low. They struggled with students not being engaged, turning in work late, and absenteeism. This agrees with research that shows that students in high-need districts were more likely to not do work during the COVID-19 lockdown (Catalano, 2021).
Student engagement was a challenge during this time for all teachers, especially high-need school teachers who faced very low engagement from students and absenteeism. It is speculated that, at least partially, this might be connected to the low expectations that teachers had adopted. A reduced expectation from teachers also has a correlation with reduced engagement from students. If expectations are low, engagement declines. A study showed that teacher expectations impact student performance in two cognitive domains: perception of academic self-efficacy and engagement (Tyler & Boelter, 2008, p.36). In the United States, students' perception of academic “self-efficacy” as well as behavioral and emotional engagement were statistically related to teacher expectations (Tyler & Boelter, 2008). Students' perceived low teacher expectations have been statistically linked to poor engagement (Demanet & Van Houtte, 2012) in Flemish secondary schools. In conclusion, teachers reduced their expectations for valid reasons but this led to a decline in student engagement, and that further reduced teacher expectations. Thus, it became a feedback loop in some way.

According to the “expectancy effect process” model (see Figure 2) as described in chapter 2, teachers treat students in different ways based on their expectations (differential treatment). It might be worth mentioning perhaps that teachers perceive their treatment of students to be less differential than how students see it, who reflect on teacher differential treatment astutely from as young as six years old (Le, 2014). So, the low expectations that teachers had and how it might have affected students could be
potentially worse, as these low expectations (and thus the mediated differential behavior) was reported by teachers and we don’t have students’ voices here.

Very few qualitative studies have deeply described how and why teachers develop expectations and treat students differently based on these expectations. Neither are there enough qualitative studies to explain how and why students react to differential treatment, and how and why this improves or limits their learning outcomes (Johnston et al., 2019). This study adds value to that missing piece of literature.

Another key factor that might be related to student engagement is the impact of the grading system. We saw this was worse for high-need schools who went to a Do No Harm grading system, which resulted in very low student participation and engagement. Some research had suggested that Do No Harm might increase the inequity and unfairness in the classroom (Castro et. al, 2020), and this study shows that the four high-need school teachers in Maine did struggle with this issue. To resolve it, they ended up being very lenient while grading work of students who were still turning things in.

Additionally, this study also found out how differentiation of instruction was affected. Some elements of it were easy (like providing one-on-one feedback) while others were hard (collecting informal data during synchronous classes), which agrees with research done on differentiation of instruction (DOI) during COVID times in Maine (Tyrinna, 2021). However, teachers introduced ample choices-based differentiation for students, and provided multiple opportunities for them to succeed based on their interests, which in general is a good practice (Kanevsky, 2011).

Moreover, this research study also highlights that teachers don’t necessarily teach or assess crosscutting concepts (CCCs) intentionally. In fact, there is research that argues that CCCs have no scholarly basis for what the sciences have in common (Osborne, 2018). On a lighter note, some researchers do acknowledge the non-intuitive nature of CCCs and propose ways to use them that have the potential to make the classroom more equitable (Cooper, 2020).

Lastly, some challenges were unique to middle school teachers (Myra and Hope), such as students struggling to communicate via texts and written work, doing independent work, and being accountable.
Thus, with new priorities and lower expectations, the teaching and assessment approach changed. These changes in approach led to change in methods and strategies of teaching and assessment for teachers. These new methods were also related to factors outside the classroom, which is discussed in the next section.

**FACTORS OUTSIDE OF THE CLASSROOM**

Factors outside the classroom also affected teaching in different ways such as parents-related, admin-related, and personal.

Affluent teachers mentioned that their administration was mostly supportive whereas high-need school teachers felt they did not receive enough directions and support from the administrators. Teachers guidance and support (via admin) are essential to help students navigate in the online learning process (Dong, 2020).

Moreover, parents at affluent schools were also generally more supportive and invested in their students' learning and college careers whereas high-need school teachers felt challenged and not supported by students’ parents. In the context of the pandemic, the role of parents became more important in student engagement (Khlaif, 2021). Research shows that effective communication between teachers and parents was crucial to guide students (Kong, 2020), which high-need teachers were not able to establish. Lack of parental support was a big challenge for teaching online during the COVID-19 (Shamir-Inbal & Blau, 2021), which our high-need school teachers faced the most.

This can also be linked to teacher expectation, and thus, with the variation in teaching rigor. Attributes related to family background have contributed to teachers’ formation of expectations, such as perceived parental involvement in high school (Kupermine et al., 2008) and parental aspirations (Crozier, 2009; de Boer & van der Werf, 2015). In addition, studies have also established that perceived level of support from school (for example administration) and community (for example parents) is linked with
teachers' expectations (Doyle, 2014). Thus, as high-need school teachers struggled with both administrative and parental support, their expectations were impacted severely.

Personally, all teachers felt that online teaching was time-consuming and exhausting, at least in the beginning. Many of them did not feel very satisfied with their teaching, and felt they couldn’t support their struggling learners as much. They also struggled with technology, which was common across the globe during remote teaching (Shamir-Inbal, 2021). To compare, affluent school teachers experienced internal conflicts with cheating issues and screen exhaustion, whereas high-need school teachers struggled with home environments and student absenteeism.

LESSONS LEARNED AND VISION FOR THE FUTURE

In the face of these challenges inside and outside the classroom, teachers persevered and used many successful strategies. In general, reducing expectations and letting-go was found to be a common approach among all teachers, which is also in agreement with research (Palloff and Pratt, 2003). In addition, collaborating with peers, streamlining teaching and assessment, and being consistent with students helped.

Many teachers were grateful that they had the opportunity to try new things, and for all the new technical knowledge that they gained. It is widely reported that after teaching remotely, teachers online self-efficacy with technology has increased (Ma, 2021). Teachers hope to continue to use Google Classroom in the future. Moreover, for the future, many teachers are hoping for more synchronous classes, and are working on finding alternative ways to make hands-on, active-learning, and lab activities happen while being remote.
Limitations of the study

The first limitation of this study is that it is a qualitative study with a small sample size of 10 teachers, and so these results are not generalizable statistically. However, the goal of any qualitative study is not generalizability (Lincoln & Guba, 2000) but to give a rich, contextualized understanding of the phenomenon. Thus, the findings of this study are limited to the participants in this study and may not be a true representation for all teachers in Maine. However, the meaning derived from the evidence (transcripts) is true beyond these participants.

The second limitation is that when discussing general findings that were true for all participants, some exceptional cases were purposefully excluded. It is important to remember that this is a phenomenological study, so we are interested in sharing a story that is the essence of all these lived experiences by teachers and not necessarily true for all teachers in all situations.

The third limitation is that while doing comparative coding analysis, several features of affluent schools were sometimes true for one of the teachers in high-need school (for example Hank had a supportive administration) and vice versa, however, those small subtleties were overlooked to understand the overall differences. Rather than nuances, the study was more focused on finding what was common for either most teachers in this study or for most teachers in a certain category (affluent, middle-level, and high-need).

Lastly, it is important to acknowledge that in qualitative research the researcher is the instrument. Moreover, in phenomenological research, it is important to bracket out the biases of the researcher, which is ideally never achieved in its entirety. Nevertheless, it is important to acknowledge that the primary researcher was an international student from India, and had little to no exposure to how school systems in the United States work at the time of data collection. However, this limitation also gives this research a unique edge, as the researcher was not biased (due to lack of familiarity) with the existing inequities in Maine schools.
Recommendations

This study has various recommendations ranging from curriculum and policy makers to teachers in the classroom. To begin, the goal of the No Child Left Behind Act (NCLB) for K-12 is still at distance in Maine, given the inequality in the school system. Some researchers claim that NCLB distributes unequal resources across schools serving wealthy and poor students, and that there is a shortage of well-prepared teachers in high-need schools. This study did see that students in high-need districts struggled with technology access, so this might inform policy makers to take initiative to distribute more funding to schools who need it the most.

In terms of students, the severe impact on students in high-need schools and their unique challenges of higher emotional needs recommends the allotment of good counselors and social workers in these school districts. The impact on special needs students educate us that we need to be more mindful with them when bringing technology into the classroom as they might need additional support. In addition, the students who did unexpectedly well during online learning tells us that our classrooms are not necessarily designed to bring out the best in every child, and some research might be needed on how to continue the positive behavior and achievement of these students in regular classroom settings.

In terms of teacher expectation, as this study shows, the teachers in high-need schools usually have lower expectations of their students, for various valid reasons (such as low parental involvement). This informs us that we need more professional development for teachers in these schools to help them have higher expectations and to use the teaching strategies of such high expectation teachers. It is possible with effort and support, as the CalPrep school in California has shown (Reed & Cortez, 2016). This study also highlights that there might be a correlation between priorities and teacher expectations, and further research might need to be done in this area.

In terms of teaching and assessment, many teachers expressed gratitude that they had the opportunity to become more open-minded and creative during this time, as the assessment was not as rigorous. This has potential to make teaching more satisfying as a profession. Perhaps we need to have more open-ended lesson plans, and not everything taught should be assessed (or assessed in a
comprehensive way). Also, given the struggle with student engagement, it might be recommended that more research be done on how to keep students engaged during online classes, if we ever go back to remote learning.

Further, remote learning during lockdown reminded us that parents are important stakeholders in their children's education. Very few professional development programs focus on how to have effective communication with parents and how to get them more invested and involved in their child’s education, especially for high-need schools. Thus, more research on this matter might be useful. Moreover, the role of administrators is equally important, and this study indicates that some initiative to have more positive communication between teachers and administration at high-need schools is necessary.

Finally, it can be an interesting future study to ask similar questions related to assessment and teaching from these ten teachers now, considering the early pandemic is almost behind us, and to see how their answers would or would not differ.

To summarize, more research can be done for supporting our students, teacher expectations, creative teaching methods, and how to bring parents into the equation of child’s education are some of the potential recommendations of this study.
CHAPTER 6

CONCLUSION

In conclusion, as reported by our teachers, students were impacted in all schools in terms of their emotional health, lack of routine and structure, being bored, struggling with study space, and not being able to receive differentiated instruction. However, these impacts were more severe for students at high-need schools who struggled with emotional health issues (such as anxiety), technology accessibility, and poor study environment compared to the students at affluent schools whose common challenge was motivation and missing the social aspect of school. Also, where some struggling learners blossomed during the remote teaching, special needs students were most severely impacted.

In the wake of these impacts on students during the COVID-19 remote instruction, teachers shifted their priorities from academics to the health and safety of students, contacting them regularly and being available for them, and keeping them engaged. In addition to these three common priorities, high-need school teachers were concerned with high emotional needs of their students whereas affluent teachers were concerned with the social-emotional challenge given the difference in impact on their students.

Once the priorities shifted, the expectations for students' academic learning outcomes reduced in all schools. This was also a way for teachers in all schools to be more fair and equitable to students, given the severity of impact on them. Again, high-need schools reduced their expectation much more (to partial completion and effort) compared to affluent schools (to less depth and exposure over mastery) given the variation in the struggle of students at home.

These reduced expectations, shift to online platforms, and new grading system (or criteria), changed how assessment and teaching happened for our teachers. In general, assessment became more
streamlined and teaching rigor reduced. Classrooms became more driven by content rather than practices. Teachers struggled because of not being able to do informal formative assessments and teach using hands-on activities and active learning methods. There was no group work, and teachers were challenged with technology. Lastly, teachers did their best and tried new things in class to retain student engagement and attendance, which declined mostly with time.

Factors outside the classroom also affected teaching in different ways such as parents-related, admin-related, and personal. In terms of both in-school (admin) and outside-school (parents), affluent school teachers felt supported whereas high-need school teachers felt challenged.

Teachers felt that online teaching was time-consuming and exhausting, at least in the beginning. Many of them did not feel very satisfied with their teaching, and felt they couldn’t support their struggling learners as much. To compare, affluent school teachers experienced internal conflicts with cheating issues and screen exhaustion, whereas high-need school teachers struggled with home environments and student absenteeism.

In the face of these challenges inside and outside the classroom, teachers persisted and used some successful strategies. In general, reducing expectation and letting-go, collaborating with peers, streamlining teaching and assessment, and being consistent with students helped. Many teachers were grateful that they had the opportunity to try new things and to learn all the technology pieces. They hope to use Google Classroom in the future. In addition, for the future, teachers are hoping for more synchronous classes, and are working on finding alternative ways to make hands-on, active-learning, and lab activities happen.

Lastly, it was also learned that different grading systems affected teaching differently. Do No Harm school teachers felt most challenged as they struggled with student absenteeism and lack of participation. Next, some elements of differentiation of instruction became easy while others were hard, and teachers differentiated a lot more based on student-choice during remote teaching. It was also seen
that students at high need schools require extra emotional support, teaching at middle school has its own unique challenges, and crosscutting concepts are not generally assessed in schools. These were all summed up in Chapter 5 as minor findings.

To summarize, the inequity built in Maine schools, based on socioeconomic factors, got exacerbated during the COVID-19 pandemic. The impact on students and challenges of teaching amplified the differences in schools. Moreover, expectations inherent to the grading system affected student attendance, engagement, and teachers ability to help students. Teachers did not have as much control and positive effect anymore due to the shift in platform and change in the grading system. The role of administrators and parents became more important than ever before. All these changes affected teacher expectations, their take on teaching and assessment, and the kind of everyday challenges faced by them. Nevertheless, in the midst of these challenges, all teachers persevered, they tried new teaching strategies, and did the best to support their students in various school districts of Maine during the lockdown of Spring 2020.
BIBLIOGRAPHY


Lincoln, Y. S., & Guba, E. G. (2000). The only generalization is: There is no generalization. Case study method, 27, 44.


Rovai, A. P. (2003). In search of higher persistence rates in distance education online programs. The internet and higher education, 6(1), 1-16.


Recruitment Email for Teachers:

Hello, my name is Anupam Raj, and I am a Master of Science in Teaching (MST) student at the University of Maine working with Michael Wittmann, a professor of physics and member of the RiSE Center and Maine STEM Partnership. I am conducting a study to understand the experience of teachers during the process of assessment after the shift to remote instruction due to the COVID-19 lockdown. I am inviting you to participate because you are a physical science teacher, and I believe your rich experience can help us understand the variety of experiences teachers have had since mid-March. Participation in this study consists of an interview that will last about an hour on Zoom. You will be asked to talk about your experiences with assessment during the remote instruction part of the school year. The first part of the interview will include general questions about your assessment experience, and the second part will ask more targeted questions about what you have learned from your assessments. Your total time commitment will be approximately 1 hour.

If you have any questions or would like to participate in this research study, I am happy to answer them. Kindly reach me at anupam.raj@maine.edu or (207) 907-5789 or Michael Wittmann at mwittmann@maine.edu or (207) 581-1237
APPENDIX B: IRB APPROVED APPLICATION

Internal Review Board (IRB) Approved Application is attached below.

Investigating teachers’ experiences with assessment during the coronavirus pandemic

Anupam Raj, MST candidate and researcher
Michael C. Wittmann, Faculty Sponsor

Funding

N/A

Summary

This work takes place in the context of the profound changes to our schools during the coronavirus epidemic. As classrooms around the world move to remote modes of learning, an opportunity arises to understand how teachers assess student learning in this new and unexpected situation. The project team will use a phenomenological research design to understand the experiences of 10 secondary school science teachers as they describe their formative assessment strategies. Data will come from interviews carried out and recorded using Zoom, an online communication tool common to most teachers in the state. The goal is to provide rich descriptions of teachers' experiences with assessment as they move from in-person to distance learning during this pandemic.

Significance

The current remote-learning situation in Maine’s schools has highlighted existing differences between districts in Maine. Many schools are small and often far apart, providing few opportunities for science teachers to collaborate, especially at times of social distancing during a pandemic. Standardized testing has shown persistent equity gaps by socioeconomic status in Maine prior to the pandemic. The current remote-learning situation presents the threat of widening these gaps for lower income students. At the same time, standardized testing has been suspended, leaving school districts to wait until the coming school year to gain information about possible gaps in learning. This project will help us understand the tools teachers can and are using to assess their students, and how they are using their knowledge to inform their instruction. Our work has the potential to inform state-wide science assessments that can be used when schools are back in session for better alignment with recently adapted Next Generation Science Standards. The proposed work will advance formative assessment practices in science education by attending to the equitable learning opportunities in the everyday lives of rural students and by identifying key outcomes that will respond to the demands of the three-dimensional learning. The knowledge gained from this study of selected, diverse school systems will have long-lasting benefits for students and teachers, the rural education system of
our state, and other rural areas of our nation.

**Methods**

We will engage in a phenomenological study to allow us to better describe the experiences of teachers in assessing their students during the coronavirus pandemic, when in-person classroom instruction is no longer possible. The over-arching research question is:

How do Maine secondary science teachers experience the act of assessment during the coronavirus pandemic?

To answer this question, we will recruit 10 teachers (see below). Each will take part in an interview (questions provided in Appendix A) lasting approximately 45-60 minutes. We will ask teachers about broader aspects of their teaching and assessment during the pandemic. These questions are designed to give us a better understanding of the nature of teachers' instruction, their goals in assessment, and their teaching philosophies.

Data will be gathered by recording Zoom conversations between the research personnel and the teachers. Backup audio recordings will be used that record the conversation locally. Data will be transcribed and coded phenomenologically, meaning that we will look for themes in responses and back up our claims using examples from what teachers say.

Data will be analyzed in the form of comparative case studies. We expect the experiences of teachers in districts or classrooms with all students having laptops and online access to be very different from the experiences of teachers in districts with limited computer or internet access, mandates against sharing of schoolwork, and lower socio-economic status. Our goal is to highlight the different perspectives and different experiences of the teachers while also highlighting shared experiences common to all classrooms and settings.

**Participant Recruitment**

We wish to interview a diverse pool of teachers. Diversity will be sought in: region of teachers’ school districts (urban, suburban, rural) and socio-economic status of student populations in the school district (as determined by percent of students in the district eligible for free and reduced lunch as documented in public statistics). Having spoken to some teachers informally about this work, we will contact these teachers about their desire to participate formally.

In the interests of time and ease, we will then use a snowball method to recruit additional teachers to this study. Starting with our initial group of teachers, we will ask for other names and contact these teachers as well. We expect that many will be part of the Maine STEM Partnership, a statewide group of teachers, administrators, research faculty, and staff at the Center for Research in STEM Education. A recruitment letter is provided in Appendix B.

To provide a rich and diverse set of stories about assessment during the coronavirus pandemic, we will select 10 teachers from varied backgrounds as our participants.
Research Personnel

- Anupam Raj is a Master’s student (Master of Science in Teaching, MST) in the Center for Research in STEM Education (RiSE Center) at the University of Maine and the Principal Investigator.
- Michael Wittmann, his Faculty Sponsor, is a RiSE faculty member, with over 25 years of experience doing IRB-approved physics education research.
- MST committee member Asli Sezen-Berrie is associate professor in the College of Education and Human Development.
- MST committee member Franziska Peterson is assistant professor in Mathematics with a joint appointment in the RiSE Center.
- The RiSE Center Research and Evaluation Coordinator, Laura Millay, will also participate in this project.

Research Experience

- Anupam Raj has no prior experience conducting research with human subjects but has completed CITI training, SMT 588 (Seminar in Science and Mathematics Education Research), and INT 601 (Responsible Conduct of Research) at the University of Maine.
- Dr. Wittmann has been in physics education research since 1994, studying student and teacher knowledge, learning theories, and assessment.
- Dr. Sezen-Berrie has done science and engineering education research for over 10 years, studying formative assessment, argumentation, and other scientific practices.
- Dr. Peterson has done mathematics education research for over 10 years, studying quantitative reasoning as used by students and teachers in mathematics and the sciences.
- Laura Millay has been active in education research for nearly 10 years, studying assessment and serving as research and evaluation coordinator for the RiSE Center since 2014.

Informed Consent

The informed consent form is provided in Appendix C. It will be sent to teachers by email before the interview.

Confidentiality

The video and audio data will be stored in secure locations to which only the research personnel have access. All data will be stored on a Google Team Drive which will be created, managed, and shared with the “maine.edu” email addresses of the individuals named in the Personnel section. Data will also be backed up on password-protected external hard drives kept by members of the research team. Data will be stored indefinitely. The digital records of all
interview participants will be assigned an alias. The key connecting the participant's real names to their aliases will be stored as a paper document in a locked drawer in Laura Millay's office. This key will be destroyed by Dec 31, 2025.

Because we are using Zoom to carry out interviews, the recordings will be cloned from the Zoom portal website, where they are automatically stored, to the Google Team Drive. No participant IP addresses will be collected. The copies of video and audio data stored on the Zoom portal website will be deleted after the interview is downloaded to the researchers’ hard drive after the interview has concluded. Because the original video and audio data may be returned to at a later time for comparative purposes around issues of assessment, we plan to keep the data on the team drive and external hard drives indefinitely.

The research team may choose to create digital transcriptions of conversations that take place within video and audio data as part of the data analysis process. They will use participant aliases in the transcription process.

Data will always be de-identified in any form of publication. Participants will always remain unidentified or receive a pseudonym. Transcripts will use aliases.

Risks to participants

The risks to participants are time and inconvenience.

Benefits

This study does not offer a direct benefit to its participants. Some interviewees may find answering questions about their assessment strategies to be a helpful experience but this would be an unintentional side effect. However, the study presents an opportunity to build on the understanding of how teachers engage in assessment and what they value as they seek to help all their students during these unexpected times that have highlighted inequities in our state.

Compensation

There is no compensation for participating in this study.
APPENDIX C: TEACHER INTERVIEW PROTOCOL

This interview will be conversational in nature. The questions provided below are meant to start the discussion and you, as the researcher, should plan to ask appropriate follow-up questions as needed. The goal is to get the participant to be as explicit as possible in their descriptions of their assessment experience.

Opening Statement: “Thank you for agreeing to participate in this interview. Please feel free to ask for clarification of any question that you do not understand. Also, you should not feel confined to answer only the questions asked. They are meant to be conversation starters. I may also ask follow-up questions. You may choose to not answer questions that you do not wish to answer. You have the right to stop the recording of this interview at any time.”

“Please know that everything you say here will be confidential and not reported in public. Only those actively involved in the research (Anupam Raj and Michael Wittmann) will know who you are, and all conversations about you will otherwise use an alias.

“I will be starting the recording of the interview at this time. Is that okay with you?”

Interview Questions:

1. What were your priorities for your students after shifting to remote instruction during the COVID-19 pandemic?

2. Before we moved to remote instruction, what were your expectations about student learning outcomes? How, if at all, did these shift after moving to remote instruction?

3. How, if at all, did your assessment methods shift following the move to remote instruction? How, if at all, did your assessment criteria shift following the move to remote instruction? What were the reasons for any shifts that happened?

4. To be more specific, what challenges, if any, did you face in assessing students in the context of the three NGSS dimensions:
   (i) Core Content
   (ii) Cross-cutting concepts
   (iii) Science and Engineering Practices

5. How did these changes in assessment influence your teaching practices?

6. How have you used formative assessment to observe your students’ learning during this time of remote instruction? Did the change in platform or methods (for example, Zoom, Google classroom, etc.) influence the feedback process?
7. How were your students impacted due to this shift to remote instruction, in terms of emotional stability, technology access, study environment, family issues, lack of routine, boredom, job security, learning style, etc.?

8. Were you able to be fair and equitable in your assessments, given the variation in impact on different students, and if so, how did you do that?

9. What were some other challenges in assessment that you faced as an instructor?

10. What were some successful strategies that helped you to overcome personal and professional challenges with assessment?

11. What do you think you have learned from these experiences that might play a role in your design of future assessments?

12. What have been some positive experiences during this whole experience?

13. Is there something that you wish I had asked, that I didn’t? Do you have anything else that you’d like to add to complete your story about the process of assessment during the shift to remote instruction?
APPENDIX D: INFORMED CONSENT DOCUMENT

Investigating teachers’ experiences with assessment during the coronavirus pandemic

Anupam Raj, MST candidate and researcher
Michael C. Wittmann, Faculty Sponsor
University of Maine RISE Center
Orono

Thank you for your consideration in participating in this research study. My name is Anupam Raj and I am currently a graduate student in the Research in STEM Education Center at the University of Maine, pursuing a Master of Science in Teaching degree. With my faculty advisor, Dr. Michael Wittmann, I am carrying out research into how teachers’ assessments changed during the move from in-class to remote instruction this academic year. My hope is that an understanding of assessment practices will let us know, in part, how Maine school districts have responded to the COVID-19 pandemic and how these decisions will affect future instruction and assessment. Please read this form and ask any questions you might have before you agree to take part in this research.

What You Will Be Asked to Do

We ask that you participate in an interview, roughly 1 hour in length, via Zoom, in which we discuss how you assess students. The interview will be recorded.

Risks

The only risks to you for participating in this study are time and inconvenience.

Benefits

There are no direct benefits in your participation to this study. However, the findings of the study are useful for science teachers in understanding assessment practices in science classrooms (in-class and remote). The findings of the study will be shared with all participants.

Confidentiality

Please know that everything will remain confidential, your name will be changed to an alias, and any field notes will be destroyed upon completion of the study.

The survey data and the video and audio data will be stored in a secure location to which only the research personnel have access. Data will be stored indefinitely.
All your digital records will be assigned an alias. The key connecting your name to the alias will be stored as a paper document in a locked drawer in RiSE Center Research and Evaluation Coordinator Laura Millay's office.

This key will be destroyed by Dec 31, 2025. Because we are using Zoom to carry out interviews, the recordings will be cloned from the Zoom portal website, where they are automatically stored, to the Google Team Drive. Your IP address will not be collected. The copies of video and audio data stored on the Zoom portal website will be deleted immediately after being downloaded to a hard drive at the conclusion of the interview. The data on the team drive and external hard drives will be kept indefinitely.

The research team may choose to create digital transcriptions of conversations that take place within video and audio data as part of the data analysis process. They will use your alias name in the transcription process.

Data will always be de-identified in any form of publication. If you are quoted, you will always remain unidentified or receive a pseudonym.

Voluntary Consent

Participating in the interview indicates consent to participate in the research study. Your participation is entirely voluntary. Should you choose to participate, you may withdraw at any time without consequences of any kind. You may skip any questions you do not wish to answer.

Questions about the Study

If you have questions or concerns during the time of your participation in this study, or after its completion you would like to receive a copy of the final summary of results of this study, please contact:

Anupam Raj, Principal Investigator, anupam.raj@maine.edu
Dr. Michael C. Wittmann, Faculty Advisor, mwittmann@maine.edu

Questions about Your Rights as a Research Participant

If you have any questions about your rights as a research participant, please contact the Office of Research Compliance, University of Maine, 207/581-2657 (or e-mail umric@maine.edu)
AUTHOR BIOGRAPHY

Anupam Raj is from a small village called Bahera Jahidpur in the state of Bihar in India. He did his high school from Patna, Bihar. Afterwards, he moved to Delhi, where he received his bachelor’s in physics from Amity University. He was also an active member of AIESEC in Delhi University, an international youth run organization for leadership development. AIESEC added a lot of value to his life and helped him gain a global citizen mindset.

After his undergraduate degree, he lived in Kashmir (India) for two years and got his first masters (in physics) at National Institute of Technology (NIT). In Kashmir, he realized that he loves mountains, and he loves teaching physics. To pursue his dream to become a world class teacher, Raj came to the United States in 2019 to study get his second MS, this time in Teaching. He expresses his immense gratitude to have the opportunity to do this research work while living in the beautiful state of Maine. Raj wants to travel the world and teach physics in different countries, and ultimately dreams to become a teacher trainer and work towards global educational equity. He is currently a candidate for the Master of Science in Teaching degree at the University of Maine.

You can reach out to him at: anupamraj0701@gmail.com