Why Teachers Teach the Way They Do:
Factors Influencing the Perceptual Teaching Styles
Of Teacher Candidates in Math Education

By: Tharanky Balachandran

A Research Paper Submitted
In Partial Fulfillment
Of the Requirements for the Degree
Masters of Teaching
Department of Curriculum, Teaching and Learning
Ontario Institute for Studies in Education of the University of Toronto
Acknowledgements

Throughout this research journey, there have been several individuals who have been pillars of support and motivation, and for whom I am deeply grateful for. First, and most importantly, I would like to thank my family for having supported, and continuing to support, every decision I make in life. I would especially like to thank my dearest cousins for encouraging me along every step of the way, my loving parents for dedicating their time to helping me so that I could devote my time to my research and education, and my precious little sister for being my rock and my inspiration to persevere. Next, a bouquet of thanks goes out to my treasured PJ141 classmates, each of them a blossom of wisdom from whom I have learned plenty. Together these friends have been the caring and helpful foundation that has built me up to the successful completion of this project and many others. A special thanks to my research supervisor, Donna Duplak, for being extremely patient, considerate, and supportive throughout this entire process. I would also like to thank all the exceptional teachers I have had the privilege of learning from throughout the years, who have been the inspiration behind my research. Last, but not least, many thanks to my research participants for taking the time to share their valuable experiences and offering important insights.
Abstract

The purpose of the present study was to explore why teachers teach the way they do. More specifically, it investigated the factors that influence educators’ perceptual teaching style when teaching mathematics. A particular focus was given to identifying teaching styles and inspecting whether it is related to educator’s own learning style preference. Using a mixed methods approach, one-on-one interviews were conducted with six teacher candidates, and quantitative and qualitative data were collected on recent practicum experiences. The data analysis yielded five key findings: teacher candidates did not significantly utilize one perceptual teaching style more than another; teacher candidates revealed a significantly higher learning style preference for visual learning, tactile learning, and kinaesthetic learning over auditory learning; only some teacher candidates are influenced by their own learning style, and learning style is only one piece of a group of factors that together influence their teaching style; these factors affecting teaching style encompass the characteristics of the: lesson, classroom environment, students, and teacher candidate; a majority of teacher candidates prefer to teach by embracing all perceptual modalities, than by matching the specific learning style preferences of each student. Potential explanations for the findings and implications are discussed.

Keywords: perceptual learning style, perceptual teaching style, math education, teacher candidates
Table of Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>2</td>
</tr>
<tr>
<td>Abstract</td>
<td>3</td>
</tr>
<tr>
<td>Chapter 1: Introduction</td>
<td>7</td>
</tr>
<tr>
<td>Problem Statement</td>
<td>7</td>
</tr>
<tr>
<td>Significance of the Study</td>
<td>9</td>
</tr>
<tr>
<td>Background of the Researcher</td>
<td>10</td>
</tr>
<tr>
<td>Research Questions</td>
<td>11</td>
</tr>
<tr>
<td>Overview of this Study</td>
<td>11</td>
</tr>
<tr>
<td>Chapter 2: Literature Review</td>
<td>12</td>
</tr>
<tr>
<td>Learning Style Preferences</td>
<td>12</td>
</tr>
<tr>
<td>Effects of Match Versus Mismatch Between Learning Style and Teaching</td>
<td>13</td>
</tr>
<tr>
<td>Teaching Style</td>
<td>15</td>
</tr>
<tr>
<td>Relationship between Teachers’ Learning Style Preference and Teaching</td>
<td>16</td>
</tr>
<tr>
<td>Factors Influencing Teacher’s Teaching Style Choices</td>
<td>18</td>
</tr>
<tr>
<td>Summary and Application of Previous Research</td>
<td>19</td>
</tr>
<tr>
<td>Chapter 3: Methodology</td>
<td>20</td>
</tr>
<tr>
<td>Participants</td>
<td>21</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>21</td>
</tr>
<tr>
<td>Procedure</td>
<td>22</td>
</tr>
</tbody>
</table>
Limitations of the Research Design ........................................... 23
Strengths of the Research Design ........................................... 25
Qualitative Data Analysis ..................................................... 26
Quantitative Data Analysis .................................................. 27

Chapter 4: Results ............................................................. 28

Teaching Style of Teacher Candidates ................................. 28
  Strategies Used for Visual Perceptual Teaching Style .......... 30
  Strategies Used for Auditory Perceptual Teaching Style ....... 33
  Strategies Used for Tactile and Kinaesthetic Perceptual Teaching Style .................................................. 35

Learning Style of Teacher Candidates .......................... 37

Relationship between Teacher Candidates Learning Style and Teaching Style ................................................................. 38

Factors Affecting Teacher Candidates Teaching Style Choices ... 40
  Factors Related to the Lesson ........................................ 40
  Factors Related to the Student .................................... 42
  Factors Related to the Classroom Environment ............... 47
  Factors Related to the Teacher Candidate .................. 49

Attitudes towards Differentiating Instruction Based on Student’s Learning Style ................................................................. 53

Chapter 5: Discussion .......................................................... 56
Summary of Findings ......................................................... 56
Connection to the Literature ............................................... 59
FACTORS INFLUENCING TEACHING STYLE

Implications ................................................................................. 62
Limitations and Caveats ................................................................. 64
Future Research ........................................................................... 66
References .................................................................................. 68
Appendices .................................................................................. 76
  Appendix A: Interview Consent Forms ........................................... 76
  Appendix B: Research Instruments ............................................... 78
  Appendix C: Participant’s Raw Scores .......................................... 81
Why Teachers Teach the Way They Do: Factors Influencing the Perceptual Teaching Styles Of Teacher Candidates in Math Education

Chapter 1: Introduction

Problem Statement

“If a child can’t learn the way we teach, maybe we should teach the way they learn”. As sensible as this statement by Ignacio Estrada sounds, it is infrequently put into action.

The way students learn, or their learning style, is the manner through which they “concentrate on, process, internalize, and retain new and difficult information” (Dunn and Dunn, 1999, p. 4). Over the years, learning style researchers have repeatedly observed that not all students learn in the same way. Students have unique learning styles that articulate the particular conditions and context under which they learn best (Alaka, 2011; Felder & Brent, 2005). Not surprisingly, studies have found that teaching styles that match students’ learning styles, also known as learning preferences, offer a wide number of benefits to students (Domino, 1979; Goodwin, 1995; Marshall, 1991). In particular, when students learn according to their perceptual learning preferences (e.g. visual, auditory, kinesthetic, and tactile), they perform better in school (Klavas, 1994; Lam-Phoon, 1986). Correspondingly, research has also found that teaching styles that do not match students’ learning preferences have detrimental effects on students’ learning (Felder, 1996; Hsueh-Yu Cheng & Banya, 1998; Reid, 1987). This highlights the importance for teachers to consider students learning preferences when making decisions regarding which teaching styles to employ in their classrooms.

However, there is wide consensus in the literature stating that traditional education does not address the learning styles of all students (Kolb & Kolb, 2005). Teachers’ teaching methods regularly put an emphasis on certain learning styles while ignoring others. More specifically,
classrooms generally support a perceptual environment in which students learn through auditory and visual means (Marshall, 1991). Furthermore, the involvement of tactile and kinesthetic learning seems to be limited in schools (Marshall, 1991). This establishes that there are incongruences between the learning styles of some students and the teaching styles of their teachers. Unfortunately, this also suggests that not all students in our classrooms are being given an equal opportunity to learn and reach their full potential. Thus it becomes imperative to examine what factors shape the teaching styles that teachers adopt in their classrooms in order to develop ways to address these issues and help teachers support all students.

Past research on teaching styles used by teachers is lacking in five principle ways. First, researchers have not yet attempted to consider the teaching practices of today’s teachers, thus the literature is outdated. Previous studies addressing this topic have found that teachers teach the way they learn best, or in other words according to their own learning styles (Mehdikhani, 1983; Lyons, 1985). Other studies have established that there are cultural differences among individuals’ learning style preferences (Dunn & Griggs, 1993; Durodoye & Hildreth, 1995; Nash, 1996; Park, 2000; Reid, 1987). Therefore, taken together this suggests that as more and more culturally diverse individuals enter the teaching profession, the learning styles, and consequently the teaching styles, of teachers today might be more varied than those observed in the past.

Second, even though there is widespread concern regarding what teaching practices teachers are using with students, as Shavelson and Stern (1981) point out, there has been insufficient investigation and information on why teachers choose the methods they do (as cited in Gordinier, 2002). Marshall’s (1991) research, one of the very few studies, revealed that in addition to choosing teaching practices that reflect the way they themselves learn, teachers assert
that they teach according to the way they were taught, and what they believe is the easiest way to
cover the teaching material. But once again as the cohort of individuals in the teaching
profession is changing, the rationale behind their teaching methods might also differ.

Third, the substantial value of teaching students according to their learning styles,
repeatedly underscored by research over the past few years have really brought this aspect to the
forefront of teachers training. Thus today’s teachers might be more knowledgeable and sensitive
to the learning styles of their students, especially when deciding on teaching styles, than the
teachers of the past.

Forth, previous research has primarily focused on the effects of matching versus
mismatching student’s learning styles with teacher’s teaching styles on students, but they have
not yet attempted to identify the dynamics of factors leading to this match or mismatch, such as
the teachers own learning style preferences.

Fifth, and accordingly, no studies have yet attempted to determine how these factors,
including the perceptions and attitudes of educators, shape their instructional decisions as they
are developing their teaching style.

**Significant of the Study**

Students whose learning styles are not embraced by traditional school systems are at risk
of not reaching their full potential as their strengths are overlooked. Therefore it is the
responsibility of teachers to acknowledge these differences in students’ learning styles and
accommodate all students in their teaching. However, in order for teachers to affect such a
practice, they must first be mindful of their own learning style preferences and other factors that
affect their teaching practices. Knowledge about the relationship between these factors, such as
their learning style and teaching style, will help teachers reflect on the current methods they incorporate in their classrooms (Gordinier, 2002). Along with present full-time teachers, this research can be beneficial in offering guidance to teachers’ training programs so that that can promote the development of more effective teachers.

**Background of Researcher**

As a female from a minority culture – these were two significant aspects of myself that shaped my everyday experiences both outside and inside of school. If I perceived these aspects to be contradictory to mainstream standards and felt excluded, then it negatively shaped my attitudes, behaviors, and experiences. However if I perceived my differences as consistent with mainstream standards, or even contradictory to mainstream standards but felt acknowledged, then it positively shaped my attitudes, behaviors, and experiences.

As a South Asian female student, I sometimes felt that the ‘traditional’ education system in Canada promoted a male, majority culture learning environment. For example, in my culture, parents promote and stimulate visual and tactile means of learning, which was my principle way of learning, while my classes supported auditory, book-based learning. Starting off having learned one way and developing a preference for that style, it was a struggle for me to accommodate this new way of learning practiced in my school.

I felt frustrated as I saw my differences as barriers to my own education and success. I was annoyed and I resented the system because my differences were ignored. I was taught that America was a melting pot where all people conformed to one standard, while Canada was a salad bowl that embraced diversity. However, this was not true of my school experiences.
Therefore I feel that it is imperative for teachers to identify and acknowledge students' individual differences, including their learning preferences, in order to be successful in fostering an inclusive, equitable, and efficacious learning environment. However, in order to affect such a practice, teachers must first be aware of how their own differences and other variables mold their decisions in their classrooms, specifically their instructional choices.

Research Questions

Central Question: What factors influence the perceptual teaching styles that teacher candidates employ in teaching mathematics?

Sub-Questions: (1) What are the perceptual teaching styles that teacher candidates employ in teaching mathematics in their practicums?; (2) what are the perceptual learning styles of teacher candidates?; (3) what is the relationship between teacher candidates teaching style and their own learning style?; (4) what factors do teacher candidates identify as influencing their perceptual teaching styles in regards to math education; and (5) what are teacher candidates’ views about differentiating instruction based on student’s learning styles?

Overview of Study

In addressing the research question, this study employs a mixed methods approach entailing the collection of quantitative and qualitative data through one-on-one interviews with teacher candidates. Chapter 2 explores the literature on perceptual learning style preferences, the importance of integrating students learning styles, teaching styles and traditional teaching practices, the relationship between teacher’s learning style and teaching style, and factors influencing learning teaching style and learning style. Chapter 3 reviews the research design and
methods that were employed to carry out this research, and chapter 4 describes the findings of the study. Finally, Chapter 5 examines the research findings in light of the existing literature and highlights its possible implications. It also provides directions for future research on the topic.

**Chapter 2: Literature Review**

**Learning Style Preferences**

Learning style preferences have been extensively studied in research. Throughout the literature, researchers have continually documented that individuals have unique learning style preferences (Alaka, 2011; Felder & Brent, 2005). A primary learning style preference generally forms early in life and is stable throughout life (Keefe, 1987).

Hunt (1979) asserts that learning style “describes a student in terms of those educational conditions under which he is most likely to learn” (p. 27). Learning style researchers, Dunn and Dunn define learning style as “the way each individual begins to concentrate on, process, internalize, and retain new and difficult information” (1999, p. 4). Cornett (1983) adds, learning style is “a consistent pattern of behavior but with a certain range of individual variability” (p. 9).

Dunn and Dunn conducted research in American schools and observed differences in students’ learning style preferences (1972). They identified five fundamental stimuli that encompasses an individual’s learning style: (a) environmental, where we learn best, (b) sociological, with whom we learn best, (c) emotional, what motivates us to learn and what affects our attitudes towards learning, (d) physiological, when and how we physically engage most in learning, and (e) psychological, how we process and respond to information.

One of their findings was that learners have different perceptual learning styles, or different ways of using one or multiple senses to perceive, understand, organize, and retain
experiences – this falls under the physiological aspects of the learning environment along with intake, time of day, and mobility (Dunn and Dunn, 1979). They identified four types of perceptual learners: auditory learners who learn through listening to information, visual learners who learn through written or pictorial images, tactile learners who learn through using their fine motor skills, and kinesthetic learners who learn through experiences using their entire bodies (Dunn, 1983).

**Effects of Match versus Mismatch between Learning Style and Teaching Style**

There are numerous benefits of using teaching strategies that match students learning preferences. In comparison to students whose learning preferences are incompatible with the teaching strategy, students whose learning preferences are compatible with the learning strategy have greater factual knowledge and higher scores on tests (Domino, 1979), increased grades (Ford and Chen, 2001; Marshall, 1991; Napolitano, 1986), gains in academic achievement in English (Goodwin, 1995), increased learning in the online environment (Koslo, 2010), more positive attitudes towards school (Domino, 1979; Marshall, 1991; Napolitano, 1986), and improvements in behaviours (Marshall, 1991). There are also improvements in students’ academic achievement and attitudes towards learning, when their homework assignments also address their learning style preferences (Geiser et al., 2000-2001; Lenehan, Dunn, Ingham, Murray, & Signer, 1994; Turner, 1992).

In studies that have examined specific learning style preferences, these gains are still significant. Particularly, research that has specifically focused on the effects of matching perceptual learning preferences of students has found beneficial outcomes (Boulmetis & Sabula, 1996). In Martini’s (1986) study with grade seven students, science lessons were taught through
auditory methods using cassettes, visual methods using reading materials, and tactile methods using a computer. When mean science test scores were calculated, the results indicated that students had higher achievement when the teaching method was congruent with their perceptual learning preference, than when it was incongruent.

Martini also found that attitudes towards the teaching method were more positive when the teaching method matched the students’ perceptual learning preference. These results are coherent with other studies with different age groups, which have not only established that there are benefits in matching students primary perceptual learning preferences, but also matching students primary and secondary perceptual learning preferences in conjunction (Kroon, 1985).

Klavas (1994) studied how matching students learning style preferences influenced a failing elementary school in North Carolina. Immediately after the implementation of matching teaching styles, there were improvement in the students’ behaviour. Over the three years of the program, there was a major decline in the number of discipline referrals from 143 to a striking 6-14 (Klavas, 1994). Students’ standardized test scores also increased progressively with the most advances reported for African American students (Klavas, 1994). Changes to practises to fit students learning preferences, once again, were concluded to have constructive consequences.

Some individuals, like John Hattie, in his book Visible Learning for Teachers: Maximizing Impact on Learning (2011), assert that there is no support for learning styles as a significant factor affecting student learning. However meta-analysis conducted on this topic provide strong evidence in contradiction. For example, Dunn, Griggs, Olson, Beasley, and Gorman (1995) did a meta-analysis of 42 studies examining students learning preferences and the effects of matching and mismatching teaching styles. Results showed that students whose learning style preferences were matched with teaching strategies could be expected to score 75%
of a standard deviation higher than students whose learning style preferences were not matched with teaching strategies (Dunn et al., 1995). In the 42 studies, achievement gains were noted for elementary schools, secondary schools, and college students, as well as special education students and mildly handicapped students ((Dunn et al., 1995). Thus, the practice of matching teaching style to students’ learning style preference seems to have a wide spread and consistent positive effect on students’ learning and achievement.

Complementing this notion, discrepancies between students learning preferences and teaching styles are related to academic failure, frustration, and decrease in motivation (Felder, 1996; Hsueh-Yu Cheng & Banya, 1998; Reid, 1987). Persistently mismatching students learning preference with teaching style eventually leads to lack of motivation and negative attitudes towards learning (Lawrence, 1997). Students become discouraged and disengaged from learning when learning does not come easily (Dunn, Dunn, and Price, 1979). However, when teachers personalize lessons to complement students’ learning preferences it promotes interest and participation, and permits students to derive meaning from the activity and content (Horton & Oakland, 1997).

**Teaching Style**

Teaching style is defined as the identifiable and consistent teaching practices that teachers use, that do not vary as content in class changes (Fischer and Fischer, 1979). These consist of the same five stimuli associated with learning style: (a) environmental - where students are taught, (b) sociological, with whom students develop their knowledge with, (c) emotional, how students are motivated and how attitudes towards learning are enhanced, (d) physiological, when and how students are physically engaged, (e) psychological, how students are expected to
process and respond to information. Various instructional methods correspond to particular learning style preferences. For example, teaching practices such as conducting experiments, role playing, learning through games, etc. support a tactile/kinesthetic perceptual learning preference.

**Traditional teaching styles.** Marshall (1991) conducted an in-depth study that collected information from over 9,000 teachers on their learning styles and teaching styles. Teachers identified their practices in the classrooms, which were conventionally recognized as “traditional”, including students sitting in rows, quite learning environments, formal classroom design, teacher-dominant learning, whole-group instruction, textbook/lecture format, visual and auditory learning, low or no mobility, and emphasis on writing (Marshall, 1991).

Likewise, learning style preferences that are not supported by the practices in traditional school systems include: preference to learn with low light, informal classroom design, structure, opportunities to learn with others, greater occasions to move around in class, tactile/kinaesthetic methods of learning, and right hemispheric or global learning situations (Griggs and Dunn 1988).

Thus, traditional teaching styles do not support the learning style preferences and needs of all students within the classroom. Specifically, students with visual and/or auditory learning preferences are more supported than students with tactile and/or kinesthetic learning preferences.

**Relationship between Teachers’ Learning Style Preference and Teaching Style**

Researchers have continually noticed that the teachers’ instructional style is significantly related to teachers’ learning style preference (Mehdikhani, 1983). When Gordinier (2002) explored elementary school teachers’ learning preferences and their use of reading instruction methods in their classrooms, they uncovered that these two aspects were considerably aligned with one another. For example, teachers who had a concrete sequential learning style preference
or a preference to process information in organized, stable, and productive ways, favoured the phonics instruction method. Another study, by Lyons (1985), collected data on the instructional approaches of prospective teachers though observations and personal journals for one year. These results also provide support for the notion that instructional methods used in classrooms reflect the teachers’ specific learning preferences (Lyons, 1985).

Marshall’s (1991) study, previously mentioned, involving 9,000 teachers, found that a substantial majority of teachers both preferred to learn and teach by looking and listening, what they call “lecture/textbook learning”. A limited number of teachers asserted a preference for touching and doing, or tactile and kinesthetic learning (Marshall, 1991). The study also found that a majority of the teachers, more than 90 percent, preferred to work alone and inflicted this practice in their classrooms. The teachers felt that learning is most successful when students interacted with worksheets or the teacher, as opposed to peer groups, which they believed would be distracting when learning new and difficult material (Marshall, 1991). In addition to providing further evidence in maintenance of the perception that teacher’s teaching styles complement their learning styles, these studies also outline that teachers have similar learning style preferences that match traditional instructional practices.

Furthermore, Wilson (2011) conducted a study exploring the links between students’ learning preferences and teachers’ teaching strategies in the subject areas of math, language arts, science, and social studies. Similar to the studies just mentioned, their findings indicated that in each of these subject areas, teachers favoured auditory and visual activities more than bodily kinesthetic activities. They also noted that teachers had a higher preference for written expressive tasks, than for oral expressive tasks. While an overwhelming 97% of students specified bodily kinesthetic as their preferred mode of learning (Wilson, 2011). These results indicate that there
were clear discrepancies between the instructional styles used by the teachers and the learning preferences of their students.

The results of these studies are problematic because they imply that teachers’ instructional styles are guided by their own learning style preferences, while on the other hand studies noted previously have highlighted the importance of matching students learning style preferences with complementary instructional styles in order to improve student learning, achievement, attitudes, and behaviours. Thus, it becomes critical for us to raise the question of why teachers teach the way they do.

Factors Influencing Teachers’ Teaching Style Choices

When Marshall (1991) asked teachers this very exact question – why do you teach the way you do? – the answers were consistently the same. Teachers gave one or more of the following reasons for decisions regarding their instructional style: it’s the way I learn, it’s the way I was taught, and it’s the easiest way to cover the material (Marshall, 1991). This suggests that not only do teachers use instructional practices in their classrooms that are mainly based on their own learning style preferences, but that they are also aware that their own learning style is shaping their classroom practices. Brown (2003) says “Since a great many teachers have experienced academic success in learning environments that were instructor centered and relied heavily on lecture, it is understandable that their preferred style of teaching, at least initially, would be to repeat what worked with them” (p. 1). Marshall (1991) further explains “it was the way they were taught, and they had been successful. They had experienced a good match of environment, method, and learning style. And, reinforced by their successes within the system, they returned to continue this instructional pattern. In planning instruction, an assumption had
been made: The way I learn is the way everyone learns” (p. 226). Consistently, Heimlick and Norland (2002) and Shavelson (1983) note that instructional practices of teachers are filtered through the beliefs and values the teacher holds. The belief that all students learn the same way, and more importantly, the belief that all students learn in ways that are identical to your own ways of learning, can guide a teacher’s decisions regarding their instructional practices in a way that obstructs the learning process of many students, specifically those who embrace learning styles that are non-traditional or different from those of the teacher.

Summary and Application of Previous Research

Past research indicates that students have unique learning styles that express the particular conditions and context under which they learn best (Alaka, 2011). Findings also express that matching students’ learning style preference with teaching styles is essential to enhance students’ learning and achievement. However, teachers’ teaching styles seem to maintain and promote certain traditional styles of learning while ignoring others. Teaching styles also seem to be guided by teachers’ own learning style preferences rather than those of their students. Therefore, it is highly imperative to examine this dynamic and ascertain why teachers teach the way they do.

Teacher candidates were selected to explore this topic given that they are currently in the process of developing their teaching style through educational and practice teaching experiences, thus, designating the factors that influence this development imperative to study. In addition, unlike studies of the past which are outdated, and consequently irrelevant, due to examining cohorts of teachers who might not still be practicing the profession, teacher candidates
represent the most recent cohort of upcoming teachers, offering insights into the changes in
and between the variables investigated in this study, including teaching style and learning style.

Thus, this study endeavored to explore why teacher candidates taught the way they did in
their practicums. More specifically, this study strived to identify the group of factors that explain why
teacher candidates used the perceptual teaching styles that they did in teaching mathematics.
Mathematics was chosen to give the study a narrower focus and to help concentrate teacher
candidate’s answers regarding their teaching style. It was also elected as result of it being a
subject that allows for all perceptual modalities to be equally accommodated. In addition, this
study examined the learning style preferences of teacher candidates, and explored whether the
teaching practices of teacher candidates, like teachers of the past, predominantly reflect their
own learning styles, making it one of the factors affecting their teaching style choices.

Chapter 3: Methods

To answer the research question, a mixed methods approach entailing the collection of
both qualitative and quantitative data was used. A combination of a literature review, face-to-
face interviews, and a questionnaire were employed to acquire information. First, ethical review
procedures for the Master of Teaching program were followed. Second, a thorough review of the
research literature on the relationship between learning style preferences and teaching style was
conducted. Next, 6 teacher candidates were recruited to participate in the study based on
convenience sampling (available teacher candidates at the Ontario Institute for Studies in
Education) and purposive sampling (participants from a range of different cultural backgrounds).
Finally, qualitative data was transcribed, coded, and analysed, and quantitative data was scored
and statistically analysed using t-statistics and Person correlations, to help answer the research question.

**Participants**

Teacher candidates in the second year of the Elementary Master of Teaching program at the Ontario Institute for Studies in Education were recruited to participate in this study. The subject pool consisted of 6 teacher candidates, 3 males and 3 females, all of whom had completed 3 practicums in elementary schools within the Greater Toronto Area. None of the teacher candidates held a degree in mathematics, and 3 out of the 6 did not take any undergraduate courses in mathematics. Teacher candidate’s comfort in teaching mathematics ranged from average to high, with a majority identifying with higher levels of comfort.

To be eligible for this study, teacher candidates had to: (1) be enrolled in the second year of the Elementary Master of Teaching program, (2) have completed 3 practicums, (3) have concluded their last practicum in a traditional classroom, and (4) have taught mathematics during their last practicum. Last practicum grades taught by the teacher candidates are: grade 1, grade 4, grade 2, grade 4 and 5 split, grade 2, and grade 6. In addition, the mathematics units taught by the teacher candidates during this last practicum include: measurement, money, addition and subtraction, data management, and patterning and algebra.

**Instrumentation**

**Measure of teaching style.** Teaching styles were assessed through examining teacher candidate’s most recent practicum experience, so that they would be better able to recall the strategies that they employed. Teaching styles were determined both quantitatively and
FACTORS INFLUENCING TEACHING STYLE

qualitatively. Through asking participants about how often their teaching style embraced each perceptual modality, during the one-on-one interviews, quantitative data in percentage value was collected representing teacher candidate’s teaching style. Other questions in the interview tapped into how specifically teacher candidates supported the four perceptual elements, providing qualitative data describing teacher candidate’s teaching style (please see Appendix B for one-on-one interview questions).

Measure of perceptual learning style preference. In this study, the Perceptual Learning Style Preference Questionnaire developed by Joy Reid (1984) was used to measure teacher candidate’s learning style preferences (please see Appendix B). The questionnaire was developed to help individuals identify the ways they learn best or their learning style preference. It contains 30 statements that tap into 6 different learning preferences, 5 statements each: visual, auditory, tactile, kinaesthetic, group, and individual. An example of a visual learning style item on the questionnaire is: when I read instructions, I remember them better. An example of an auditory learning style item is: when the teacher tells me the instructions I understand better. An example of a tactile learning style item is: I learn more when I can make a model of something. An example of a kinaesthetic learning style item is: I prefer to learn by doing something in class.

Procedure

Eligible, interested, and available teacher candidates were asked to participate in an informal one-on-one interview. At the beginning of the interview, each participant was given information about the research and its purpose, as well as the procedures the interview would entail. After reading the consent letter and signing the consent form (see Appendix A), the participant was asked some background questions regarding their practicum and the degree of
knowledge and comfort they possessed in teaching mathematics. Once answered, participants were asked about the frequency in which they incorporated each of the individual perceptual modalities in teaching mathematics during their practicums. They also were asked to provide information on the specific strategies they used to embrace each perceptual style. Then the interview continued as participants were asked to answer a list of questions addressing the other research sub-questions.

Finally, participants were administered the Perceptual Learning Style Preference Questionnaire to determine their own learning style preference. Before beginning the questionnaire participants were asked to express their level of agreement or disagreement with each statement as quickly as possible, without much thought. After the statement was read to the participant, they responded with one of five answers: strongly agree, agree, undecided, disagree, strongly disagree. The questionnaire was complete when participants had responded to all 30 items. At the end of the interview, participants were debriefed, given contact information if they had any further questions or concerns about the research, and thanked for their participation.

**Limitations of Research Design**

Certain characteristics of the sample selected for this study might bias its findings. To answer the research question the present research elected teacher candidates. Teacher candidates might differ from the full-time teacher population. For example, full-time teachers have more experience practising teaching. In addition, full-time teachers might experience obstacles or other factors that affect instructional choices that teacher candidates are not subjected to, such as full year work load and addressing the concerns of parents.
Another limitation with the design employed in this study is that participants recalled teaching experiences that occurred during practicums. Practicums and full-year classroom teaching experiences differ qualitatively – like previously mentioned obstacles such as increased work load and addressing the concerns of parents, are also factors attached to a full-year classroom experience that might not show up in a one-month-practicum. Practicums also encompass other characteristics that deem them qualitatively different, including the presence of the associate teacher. In addition, participants provided their answers by recalling only one practicum experience which might not provide an accurate picture of their true teaching style.

The selection of a questionnaire to assess participant’s learning style preference has a few disadvantages. One limitation is that when you quantify qualitative data it sometimes loses its depth and meaning. The questionnaire also requires participants to be able to understand the questions equally. However there is a possibility that some participants might not understand the meaning of a question, or read a question to have different meaning than another participant. The questionnaires can also get boring for some participants, which might lead to low motivation to accurately complete the questionnaire.

Other limitations of this design concern the interview aspect. There is a possibility of interviewer bias, which is when the interviewer subtly, and most times unintentionally, influences the participant’s answers. For example, an interviewer might unintentionally express approval or disapproval to certain answers which might in turn influence subsequent answers from the participant. Expectations that the interviewer brings to the interview might also affect the interviewer’s interpretation of the answers given by the participants, especially during the coding process.
There is also the possibility of social desirability effects on responses of participants. In other words, participants might adopt a response set, or way of answering the questions, that they feel is socially acceptable or desirable. For example, if a participant feels that an effective teacher uses all teaching styles in their practices, then they might answer the question with such a response, even if it does not accurately reflect their true teaching practices.

In addition, the open-ended nature of the interview questions yield responses that are complex and time consuming to categorize, code, and analyse and a research design that uses both a questionnaire and an interview process is further time consuming.

Finally, but most importantly, this research only consists of 6 participants. With 6 participants it is hard to determine significant effects and draw any strong conclusions. Therefore the findings of this research are not robustly generalizable due to limitations in sample size.

**Strengths of the Research Design**

The research design also has numerous strengths, some of which counteract the limitations. The presence of the interviewer while participants are completing the questionnaire has many benefits. First, the interviewer can clarify the questions on the questionnaire. Next, the presence of the interviewer might lead to a higher response rate. This is due to the fact that participants are more likely to answer the questions on a questionnaire asked in the presence of the person asking the questions, than the questions asked by a mailed or internet questionnaire. Similarly, the rapport established by the interviewer and participant can also help motivate participants to honestly complete the questionnaire. Furthermore, the quantifiable nature of the questions on the questionnaire allows data to be easily coded and analysed.
The interview design also entails several advantageous. For example, the open-ended nature of the interview questions offer important insights and depth into participant’s thoughts and attitudes. Additionally, the interview process allows the researcher to ask follow-up questions to help clarify and acquire a deeper understanding of answers.

Lastly, through employing a mixed methods design rather than solely collecting quantitative or qualitative data, this study is able to attain a more clearer picture of the factors influencing teaching styles and their level of influence, particularly the impact of own learning style preferences. The combination of the two types of data assists in filling in the gaps or further understanding the answers provided by participants.

Qualitative Data Analysis

Data analysis involved a series of steps. First, all one-on-one interviews were transcribed and then reviewed to ensure accuracy of transcription and gain familiarity with the data. Second, participants’ names were replaced with a numerical code to protect the anonymity of the participants. Next, sections of the transcripts were organized into groups based on the sub-question/sub-questions the participant’s response answered. Forth, the similarities and differences between the responses in each group were observed and coded using the procedures detailed by Creswell (2012). Within each group, several themes emerged that effectively explained the data and assisted in answering the research questions. The coding process was repeated to ensure consistency with codes across transcripts, and that no data was excluded. Lastly, all transcripts went through review to ensure that codes, and the themes that emerged from them, accurately reflected the data collected from the interview.
Quantitative Data Analysis

**Teaching style.** Teacher candidates provided percentage amounts during the one-on-one interview that represented the amount of time they spent embracing each perceptual modality when teaching mathematics. The mean of these values were calculated to determine which teaching styles were more often employed than others by teacher candidates. In addition, to establish whether there was a meaningful difference between participants’ use of the various teaching styles, t-statistics were computed.

**Learning style.** Though participants answered all 30 items on the Perceptual Learning Style Preference Questionnaire, only the ones that addressed the perceptual modalities were assessed. The other two, individual and group learning, were excluded. The answers were assigned a numerical value from 1 to 5, with 5 indicating the most amount of agreement with the statement. When scores for all five items corresponding to the learning style were collected, they were summed together and multiplied by 2, to get a final score representing the degree of preference for that learning style, with higher scores representing a higher preference. Final scores were calculated for all 4 perceptual learning styles examined in this study. Next, teacher candidates major, minor, and negligible learning style preferences were ascertained by inspecting the final scores and using the boundaries set by Reid (1984): scores from 0-24 are negligible, scores between 25- 37 represent a minor learning style preference, and scores between 38-50 represent a major learning style preference. T-statistics were then computed to uncover whether teacher candidate’s preference for one learning style is significantly different from another.

**Relationship between learning style and teaching style.** The research sub-question addressing whether there is a relationship between teacher candidate’s teaching style and their own learning style preference was examined through computing Pearson correlation coefficients,
using the data collected from both the one-on-one interview questions and the Perceptual Learning Style Preference Questionnaire.

Chapter 4: Results

The research findings were organised into five sections that each addressed the research sub-questions explored in the one-one-one interviews. The first section discusses teacher candidate’s amount and type of use of each perceptual learning style during their practicum. The second section reveals teacher candidates own perceptual learning style preferences. The third section examines whether there is a relationship between their learning style and their teaching style. Section four sheds light on the factors that teacher candidate’s identified as influencing their teaching style during their practicum. Finally, section five communicates teacher candidate’s attitudes towards differentiating instruction based on student’s learning style.

Teaching Style of Teacher Candidates

A summary of the means and standard deviations for teacher candidates’ use of the different perceptual teaching styles are listed below in table 1. The mean scores are a percentage value that represents the amount of time teacher candidates’ report was devoted to the particular perceptual teaching style within all mathematics lessons taught. Please refer to Appendix C to view participant’s raw scores on the amount of use of each perceptual teaching style.
Table 1

Means of Teacher Candidate’s Teaching Style

<table>
<thead>
<tr>
<th>Perceptual Learning Style</th>
<th>Females</th>
<th>M</th>
<th>SD</th>
<th>Males</th>
<th>M</th>
<th>SD</th>
<th>Overall</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td></td>
<td>88.33</td>
<td>16.07</td>
<td>70.0</td>
<td>26.46</td>
<td>79.17</td>
<td>22.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory</td>
<td></td>
<td>63.33</td>
<td>47.26</td>
<td>73.33</td>
<td>23.09</td>
<td>68.33</td>
<td>33.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tactile and Kinaesthetic</td>
<td></td>
<td>53.33</td>
<td>5.78</td>
<td>63.33</td>
<td>20.82</td>
<td>58.33</td>
<td>14.72</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 6, 3 females and 3 males.

Overall, visual teaching strategies were used most often, then auditory teaching strategies, and finally tactile and kinaesthetic teaching strategies. To determine whether there is a meaningful difference between participants’ use of the various teaching styles, t-statistics were computed. None of the tests reached statistical significance, indicating that teacher candidates did not significantly favour one teaching style over another. Nevertheless, differences between the amount of use of visual teaching strategies in comparison to kinaesthetic teaching strategies came close to reaching significance, t(10) = 1.9276, p = 0.0828.

The qualitative data collected during the one-on-one interviews, on teacher candidate’s teaching style, was used to examine exactly how the time dedicated to each perceptual modality was expended during the mathematics lessons. These strategies are organized into themes according to the respective perceptual modality that it supports, and are explained below.

It is important to note, and as a comment that came up in every interview, that no perceptual teaching style is employed independent of the others. Teacher candidates did not simply tell students to look at a picture of a graph and not require them to talk about it
afterwards. Nor did they have them physically measure objects and not have them report it either visually or verbally in some way. Many strategies used by teacher candidates embrace more than one perceptual teaching style, such as the use of manipulates that supports both visual and tactile learning simultaneously. However, for the purposes of this study, each strategy has been uniquely examined and categorized within the perceptual teaching modality/modalities that it aligns most closely with.

**Strategies used for visual perceptual teaching style.** The various manners in which the visual modality was supported by teacher candidates during their practicums is organised into 4 different categories:

**Pictures.** Pictures were used to both initiate and support learning math concepts. Some lessons started with images that guided the math discussion. For example, participant 5 had students explore the content within the images. More specifically, they used graphs, such as bar graphs and pictographs, drawn on chart paper to engage students when teaching data management. Another strategy was to disregard the content and focus on the images as concrete pieces, to investigate mathematics strands. For instance, participant 1 instructed students to view pictures not to examine its subject matter, but rather to “measure the framing of the picture”.

Most lessons, however, used pictures for the purpose of supporting students in learning the mathematics ideas. Participant 1 explained, “I would give them pictures of like food so they can see quantity wise…. I would give them pictures of coins” and participant 5 described “for measurement, just like visual representations of like meter sticks, tape measures...”. Participant 6 noted the use of anchor charts to represent student understanding and to function as a visual
aid. For example during the patterning unit, participant 6 directed students to represent their patterns on anchor charts for all students to view.

Finally, pictures were also employed as products of assessments and in a manner that got students excited about the math concept and lesson. For example, participant 3 said “for some lessons the kids had to make money and time, so they created their own restaurant and they were making full sized menus. So they had to draw a clock or write the time that their restaurant opened and closed. They went through magazines and things to get images of food and fruits.”

**Words and numbers.** Teacher candidates used words to communicate not only verbally, but also visually via written words, to facilitate math lessons. One mean through which words were conveyed is through the use of anchor charts. Participant 3 mentioned the application of learning goals and co-constructed success criteria on anchor charts as a visual aid to support student learning throughout the mathematics unit. Anchor charts were also used to assist students in remembering facts. For example, when teaching the unit on money, participant 3 explained “we had like a chart. We had the different coins; like the blown up images of the coins posted there and the words, and the money amounts. So that was kind of like the visual anchor chart they had that was always there for that”. What we know, what we want to know, and what we learned (KWL) charts were also utilized in teaching math. It served as a visual tool students build upon as they progressed through the unit, and as a visual representation of advances in student knowledge.

Another tool used to communicate words and numbers visually was the white board. White boards were utilized to explain concepts and take up questions. Participant 2 recounted: “for every lesson I pretty much did write on the board… then eventually at some point I would
bring everything that they had just explored and do it on the board and show them what they would be having to do”.

**Manipulatives and other objects.** Manipulatives and objects were used in mathematics not only to support students with tactile learning but also with visual learning. For example, participants 1, 2, and 3 employed money visuals, such as laminated pictures of coins and mock 3-D coins, to support students to visually understand concepts related to money, including value and amount. For example, participant 2 asserted, “I tried to bring in money into the classroom because for one lesson they had to learn about making change”.

Participants also incorporated the use of other manipulatives to aid in learning number sense and problem solving:

For one of my math lessons, we were talking about grouping numbers, and rather than just drawing stuff on the board I actually brought magnets. Like different coloured things and I stuck those on the board so it was an actual visual than just a marker on the board. (P02, Interview)

Like you know those little, little, cubes? They would use those to help them out if it wasn’t as easy for them to do it in their heads. (P03, Interview)

Participant 3 invited students to create their own visual aid that assisted them throughout the unit in learning about time: “Well for time I mean, we made clocks. So all the students had their own clock. So, they were holding something that they’d made, and then they got to touch it and it was something that they were looking at”.

**Technology.** Participant 4 explained the use of technology, such as smart boards and laptops, to support students in learning visually: “I used technology so it was visual as well. I also researched websites like virtual manipulatives. That’s where students are like you know,
literally come up to the smart board and just try and test things out. Each one of them got a laptop and they got a chance to try it on their own.

**Strategies used for auditory perceptual teaching style.** Teacher candidates embraced the auditory perceptual modality through 4 distinct processes during their practicums:

**Teacher Instruction.** Participants used verbal communication, primarily at the start of the lesson to explain mathematics concepts and provide instructions for the lesson. Participant 1 described a typical lesson as beginning with students “sitting on the carpet and I was introducing a lesson”. Furthermore, participant 2 stated “so for every lesson, I was at some point talking to them to help them learn what they had to learn”.

**Teacher and Student Questioning.** Verbal communication was also employed by teachers for the purpose of questioning in order to assess student understanding, getting them to dig deeper into mathematics concepts, and to provide them with opportunities to apply their knowledge. Participant 4 articulated, “a lot of time I asked them questions like, you know, figure out why this thing works like this, or how can you put it in a real life situation?”

Auditory modality was further assimilated in mathematics lessons by encouraging students to read questions out loud and to question the mathematics concepts and one another. Participant 6 explained his use of and rationale for this auditory strategy:

I got students to read questions aloud. Some students needed to hear the questions or read the questions... And while they are reading out loud they hear themselves and when they hear themselves they understand what the question is asking and they make sense of it better.

Most of the time when I teach something I encourage students to question it cause I feel that through questioning the students understand at a different level. I don’t believe in students just taking in information without questioning, so I always try to motivate students to discuss and talk among their peers, among small groups, and the whole class.
**Group work.** Another manner in which the auditory modality was tapped was through utilizing group work, where students spent time listening to and verbally communicating with classmates. Similar to most participants with the exception of one, participant 4 declared “I tried to incorporate as much group work as possible. That’s where the most talking comes from, the students communicating with each other or communicating with other students in the school”.

Some of these activities were done in pairs and required less time, such as think, pair, shares (P02, Interview) and quick discussions with elbow partners (P03, Interview). Other activities were in groups and encompassed multiple steps that required more time, such as assignments. Participant 2 described such an activity: “I gave them a question on the board and they tried to prove it wrong or prove it right and tell me why that question was wrong or right using four different methods”.

Participant 3 referred to the mathematics discussions among group members that were stimulated through an activity that required groups to make restaurant menus. Moreover, participant 4 called on a lesson that supports the auditory modality through assigning group work: “I gave them a final assignment, which required them to take a survey in the school. They had to ask teachers, or other staff members, or other students”.

**Whole class discussion.** Whole class discussions were a method used especially at the beginning and/or ending of mathematics lessons, for the minds on and consolidation, respectively. Participant 2 recalled how they would have students share fun stories that they found interesting during the minds on and relate the lesson to that. Participant 1, in talking about the consolidation, expressed that students typically “come back to the carpet and share their findings”. Participant 2 discussed how they employed gallery walks for the consolidation piece
as a method by which auditory learning was reinforced, where students were talking to one another about the math and reflecting on each other’s work.

Participant 3 described one way in which whole class discussion can be used during the middle of the math lesson, for the main lesson activity:

We were doing patterns and they were making patterns on these magnetic white boards they had. They were making them and then they had to orally describe their pattern, what the pattern was, like ABAB, that type of things. And then they had to explain it to the other kids. They had to describe their pattern using words.

**Strategies used for tactile and kinaesthetic perceptual teaching style.** Four different types of activities were used by teacher candidates to support the tactile and kinaesthetic perceptual modalities during their practicums:

*Interacting with objects.* One strategy commonly used amongst the teacher candidates to promote learning through doing was to have students interact with objects such as manipulatives. For example, participant 6 commented “I got them to use pattern blocks and demonstrate patterns based on what I write on the board or they could create their own pattern”. Participant 3 had students physically manipulate the clocks they made to understand concepts of time. Participant 3 also had students physically work with bills and coins to help them calculate money amounts.

When teaching the measurement unit, both participant 1 and 5 had students’ moving around and interacting with objects within the classroom to measure their dimensions. Participant 1 also had students’ measure distances from the classroom to other parts of the school.
Participant 4, on the other hand, used smart board interactions as the primary process through which students learned by doing: “the majority of the kinaesthetic is when they had to go to the smart board and show their answers”.

**Interacting with classmates.** Another strategy was to have students interact with one another to learn the concepts or solve the mathematics problems. For example, participant 1 and 5 designed a measurement lesson during which students had to interact with one another to measure each other’s height. To help students learn about data management, participant 5 started with students interacting with one another asking survey questions to collect data.

**Simulating real-life experiences.** This is a strategy where students interacted with their classmates, but these activities were designed with the purpose of creating real life, authentic experiences. For example, participant 1 established a lesson on money where the class was set up like a garage sale and students moved around interacting with one another, physically exchanging money manipulatives, as if at a real garage sale. Participant 2 created a similar situation within their classroom: “I turned the classroom into a store and I brought a bunch of toys and things from home, and I put like prices on them and made little receipts”. Students went around buying objects for money and determining appropriate change.

**Games.** Participant 2 used games that required students to move, to engage students in the lesson. One game the participant noted was “the race to 10; that dice game that Melanie had taught us. Where you roll the dice and keep adding it up and have a race with your partner.”

**Physical activities.** Participant 3 used physical activities to help students understand the concept of time:

Time is abstract, so we tried to get them to understand it through more concrete things. So say for understanding what a minute is, we said okay first we are going to see how many jumping jacks you can do in a minute. So the kids all spread out through the class and we were doing jumping jacks for a minute, so they will understand how long a
minute was. And then as an activity they had to do things with a partner... determine how many things they can do per minute... So some of them did how many sit-ups and they were grade 2 sit-ups, or how many push-ups or different things. Some of them did funny things.

**Learning Style of Teacher Candidates**

A summary of the means and standard deviations for teacher candidates’ own preference for the different perceptual learning styles are listed below in table 2. According to the Perceptual Learning Style Preference Questionnaire (1984) developed by Joy Reid, and used in this study to collect the data on participants learning style preference, scores from 0-24 are negligible, scores between 25-37 represent a minor learning style preference, and scores between 38-50 represent a major learning style preference. Please refer to Appendix C to view participant’s raw scores on their preference for each perceptual learning style.

**Table 2**

*Means of Teacher Candidate’s Learning Style*

<table>
<thead>
<tr>
<th>Perceptual Learning Style</th>
<th>Females</th>
<th></th>
<th>Males</th>
<th></th>
<th>Overall</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>M</em></td>
<td><em>SD</em></td>
<td><em>M</em></td>
<td><em>SD</em></td>
<td><em>M</em></td>
<td><em>SD</em></td>
</tr>
<tr>
<td>Visual</td>
<td>42.67</td>
<td>5.03</td>
<td>36.67</td>
<td>11.06</td>
<td>39.67</td>
<td>8.33</td>
</tr>
<tr>
<td>Auditory</td>
<td>33.33</td>
<td>2.31</td>
<td>26.0</td>
<td>2.0</td>
<td>29.67</td>
<td>4.46</td>
</tr>
<tr>
<td>Tactile</td>
<td>42.67</td>
<td>9.24</td>
<td>39.33</td>
<td>5.03</td>
<td>41.0</td>
<td>6.9</td>
</tr>
<tr>
<td>Kinaesthetic</td>
<td>43.33</td>
<td>2.31</td>
<td>38.67</td>
<td>5.03</td>
<td>41.0</td>
<td>4.34</td>
</tr>
</tbody>
</table>

Note. *N = 6, 3 females and 3 males.*
More specifically, for major perceptual learning preference, 5 participants had a major preference for kinaesthetic learning, 4 participants had a major preference for tactile learning, 4 participants had a major preference for visual learning, and no participants were identified with a major learning preference for auditory learning. When examining minor learning preferences, the results revealed that 5 participants had a minor preference for auditory learning, 2 participants had a minor preference for visual learning, 2 participants had a minor preference for tactile learning, and 1 participant had a minor preference for kinaesthetic learning. Only one participant was identified with a negligible learning preference, which was for auditory learning.

T-statistics were computed to uncover whether teacher candidate’s preference for one learning style is significantly different from another. Three significant differences emerged: (1) preference for visual learning over auditory learning, t(10) = 2.5916, p = 0.0269; preference for tactile learning over auditory learning t(10) = 3.3798, p = 0.007; and preference for kinaesthetic learning over auditory learning, t(10) = 4.4644, p = 0.0012. As the statistics reveal, participants significantly favoured the other learning styles in comparison to auditory learning; specifically, kinaesthetic learning, then tactile learning, then visual learning.

**Relationship Between Teacher Candidate’s Learning Style and Teaching Style**

The qualitative data collected on teacher candidates teaching style and personal learning style was analysed and Person correlations were computed to determine whether there is a significant relationship between teacher candidates’ learning style and their teaching style. In other words, whether teacher candidates teach the way they themselves learn best. The analysis revealed that there were no significant relationship between teacher candidates’ visual learning and teaching style (r = 0.314), auditory learning and teaching style (r = -0.164), and tactile
learning and teaching style \((r = -0.453)\). However, there was a significant negative relationship between teacher candidates’ kinaesthetic learning and teaching style, \(r = -0.909, p = 0.0120\). More specifically, the higher the teacher candidate’s preference was for kinaesthetic learning, the less they reported to have used kinaesthetic teaching strategies to teach mathematics in their practicum.

On the contrary, during the one-one interviews, when directly asked whether they felt that their own learning style affects their teaching style, some teacher candidates answered that it did to a certain extent. Participant 1 communicated:

I think I especially used the kinaesthetic stuff because I didn’t want the kids to just be sitting and me talking to them because … like I don’t learn very well when someone is just talking to me. Like I zone out or start falling asleep… And like I can listen to a certain extend but then once the teacher… like why would you spend 10 minutes telling me how to use a measuring tape, when you can simply just, you know, let me practice on my own?

Participant 3 responded:

This does also have to do with, I guess my own preference; if someone is reading something to me and they say listen to this, I will tell them no I don’t understand it because I’m not comprehending it. I need to see the words as well.

Similarly, participant 5 answered “I always had a visual. I’m a visual learner so I always need something to see” and participant 6 correspondingly replied:

I am a visual learner myself, and I usually use pictures and diagrams and graphs or charts or any kind of illustrations to help my students learn math better. When I do lesson planning I usually try to implement some kind of visual aid to help my students.

Others conveyed how their awareness of their own learning preference and the influence it has on learning, to be a factor that not only leads them to implement strategies they themselves have a preference for, but also directs them to understand and take into account those perceptual
styles embraced by all students and encourages them to support it through a diverse range of teaching strategies:

Yeah, it could be biased into the fact that I am a visual leaner and a kinaesthetic learner. Maybe that could be the issue but I was aware of it, I have to make sure I don’t get into the bias of assuming everyone is like me. I don’t’ want to generalize and I don’t want my bias to take over and influence much of my lessons. (P06, Interview)
I feel like if they are taught in a way that is more easier for them then, I believe it would be easier for them to learn. I know I’m a visual learner and if someone just talks to me or talks at me without showing me any visuals it’s harder for me to learn. It’s a lot easier if I see the visuals. (P02, Interview)

Furthermore, participant 4 perceived that their own perceptual preference had no influence on their teaching style choices: “Probably not. My first practicum it did”.

Thus, though not to a significant level as indicated by the quantitative data, the qualitative data reveals that part of some teacher candidates’ teaching style decisions regarding perceptual styles are influenced by their own learning style. However, there are also many other factors that contribute to their teaching style decisions in conjunction with their own learning style, which are outlined in the next section.

Factors Affecting Teacher Candidate’s Teaching Style Choices

Through the one-on-one interviews many factors were identified, which teacher candidates indicate influence their teaching style. These factors have been organised into 4 categories: factors related to the lesson, factors related to the students, factors related to the classroom environment, and finally, factors related to the teacher candidate.

Factors related to the lesson.

Fostering real life experiences and connections. One aspect that explains teacher candidate’s learning style choices is their tendency towards engaging students in lessons that
have real life connection. Participant 1 explained that this practice is imperative for students to develop the ability to take their understanding of mathematics within the classroom and “use it in the real world”. Participant 4 described how they connected data management with students’ everyday lives: “I first introduced a topic on what they like, like what’s their favourite music, and through that, all together as a class, we used data management and it brought some meaning towards the students. I also made it parallel to real life, for example voting or how we know what music is the top hit right now and so on.”

Decisions regarding visual and tactile teaching styles were also influenced by the need to relate learning to real life authentic experiences. For example, participant 1 expressed “I wanted them to have like real life experience with money, so just to make them a bit more comfortable”. Auditory strategies such as group discussion were also aimed at meeting this purpose: “we started off talking about like what are different holidays throughout the year and get a sense of… like actually put it into context and get a sense of what a year is. Just like oh, in January we have new years…” (P03, Interview).

**Unit of study.** A second factor affecting teacher candidates had to do with the mathematics lesson itself. As conveyed by participant 1, the decision on what perceptual style to employ “depends on the lesson and like situation”. The particular mathematics strand under study was mentioned by many teacher candidates as something that either enhanced or limited their ability to support certain learning styles.Participant 5 described how the mathematics strand they were teaching promoted their employment of visual teaching styles but restricted their use of kinaesthetic teaching styles:

So because we did data management it was all about like graphing so obviously you need the visuals to teach graphing… I used a lot more manipulatives in my previous ones as opposed to this one because I feel like with data management there’s not a whole lot you can bring in in terms of manipulatives. Cause like geometry especially, like geo-boards,
and like pattern blocks, and all that you can use. But like data management, it’s like pen and paper and let them survey each other.

Participant 1 also experienced a similar situation: “In terms of money, they weren’t really moving around. But I think in terms of measurement they were moving around a lot”.

Furthermore participant 2 noted that their selection of teaching style follows a pattern that is based on parts of the lesson: “My minds on, if I could do it, was tactile. Auditory is pretty much throughout the entire lesson. The visual I think was throughout the whole lesson as well, because it was the money and on the board.” Complimentarily, participant 6 explained how their decisions were dependent on what part of the unit they were on: “Like introduction to certain topics I would try to get the students to play with manipulatives more, work with them. They are more engaged with manipulatives. Later lessons, I would incorporate more visual, auditory”.

**Teaching styles used in other subjects.** The third factor related to the lesson, and that influenced participant 4’s selection of teaching styles for their math lesson, was the teaching styles they supported in the lessons for other subjects: “It depends on other subjects as well. So let’s say I focus a lot of kinaesthetic in language, then I want to focus more on auditory in math. Balancing the strategies across the curriculum”.

**Factors related to the student.**

**Class composition.** One factor related to students that participant 6 noted as influencing their instructional style choices is the unique class composition of the students in the class: “you can’t use just one style and implement it to all grades, all students” (P06, Interview).

**Grade level.** Participant 6 asserted “my teaching styles are different from grade to grade”. Students’ grade level was one student characteristic that teacher candidates considered when
making teaching style choices. Statements by participant 2, 3, and 6 reveal how their perceptions of the importance of incorporating particular learning styles with younger students affected their teaching style choices:

Because it was a younger grade, I felt more obligated that I had to use the visuals in every single lesson and so I did. (P02, Interview)

My first one was kindergarten so there were a lot of moving around with math and touching things. Much more of the tactile because first of all, you don’t want them sitting on the carpet for so long. So that would definitely be.. like tactile was number one. Especially for the kindergarten kids having them move around and touching things was much more important to them being engaged then say a picture or something like that. (P03, Interview)

Grade 3 student I had from last practicum, I would use a lot of auditory stimulation. (P06, Interview)

*Developmentally appropriate instruction.* Teacher candidate’s perception of students’ cognitive and social development, and thus their ability to benefit and learn from each perceptual style, was another factor that influenced decisions regarding teaching styles used in lessons, especially their choice of auditory strategies. More specifically, participants felt younger students didn’t have the attention span required to benefit from the instruction when the primary mode of instruction was auditory: “I think that listening is really hard for any human being. It takes a lot of energy to concentrate and listen... kids are still developing that skill” (P01, Interview).

Participant 3 recognized differences in the level of development of auditory skills between younger versus older students. In comparing grade 2 students with kindergarten students, Participant 3 asserted: “their attention span was a little bit greater and they are able to have more discussions with their peers. Like kindergarten kids don’t want to sit there and
listen to me talk, or have a discussion. Participant 4 felt similarly about the attentional competencies of older and younger students: “they were a lot older, 4/5 split. They are okay with sitting down for a period of time, but you know even they have their limits as well”.

Participant 3 also emphasized the difficulties younger students have with auditory learning and the need for it to be paired with visual information: “as adults, well some adults, it’s easier for us to digest information if someone is speaking it to us. But for younger children, when they are just learning something, they need to also see it as well”. Participant 1, on the other hand, believed that kinaesthetic and tactile modes of instruction, rather than auditory, are more effective teaching styles in regards to students ability to benefit from the teaching method: “like why would you spend 10 minutes telling me how to use a measuring tape, when you can simply just, you know, let me practice on my own”. Similar conclusions were drawn by Participant 2 based on their observations of students appreciating and profiting from using manipulatives during mathematics lessons: “for the rest of the while I was there, they asked if they could use actual money to do the questions and I was like sure they are right there, go ahead.”

Along with differences in ability to stay focused, Participant 3 mentioned language, especially vocabulary development, as a factor moulding their attitudes towards using auditory strategies: “sometimes students either don’t have that math vocabulary or don’t know how to express themselves...or they don’t want to talk, they want to be touching things and playing with things”.

**Student engagement.** The most influential factor shaping teacher candidates instructional decisions, which was mentioned by all teacher candidates, is the level of student
engagement perceived to be achieved through the employment of the particular teaching strategy:

Actually when I started my practicum in that grade 4 class, I remember the first week my AT was teaching math and one of the kids at the back was like oh man, they didn’t sound excited about it. And that kind of drove me to make math interesting. I think my teaching is mainly around the children, and what I think is interesting to them. (P02, Interview)

Participant 1, for instance, felt that visual strategies were more engaging than auditory ones: “when you see something like visually, it sparks your attention more than when you’re... so if you are listening to a description of something, versus you actually seeing the image in front of your face ... I think that’s a bit more stimulating for kids”. The teacher candidate also expressed this to be a true characteristic of their students: “they didn’t really respond well to auditory teaching... they get more bored, I think, when you are talking, just talking, and they have to listen”.

As underscored in the previous section, because participants felt that students, especially younger ones, had not yet developed the attention span required for auditory strategies, they sensed that it would not be able to engage them in math lessons to the extent that the other strategies are capable of: “Auditory, definitely I think, younger kids especially, they don’t want to listen, they rather would be doing things” (P03, Interview).

Participant 5 explained how their interpretation regarding the amount of engagement attained through the auditory modality versus the tactile modality influenced their instructional choices:

I feel like I just go on too long or just talking about nothing. And I like caught myself so many times this last placement just being like “where do you start on like the ruler, do
you start with the 1 or the 0?”, and like I would just catch myself and I would get bored of myself. And I would be like okay forget it, let’s just do it. (P05, Interview)

Like the last quote highlights, one strong reason why teacher candidates choose tactile and kinaesthetic teaching styles is due to their perceptions of its ability to captivate student engagement: “Just being on the promethean board is just kind of a motivation factor” (P04, Interview). Moreover, participant 2 described how this perception of engagement associated with the perceptual styles, guided them to implement a hand-on, interactive mathematics lesson:

So before even getting into the lesson, cause I thought it would be sort of boring for them, I turned the classroom into a store and I brought a bunch of toys and things from home and I put like prices on them and made little receipts. And before I did anything, half the class I hired as my cashiers, and the other half I gave 22 bucks to each student. And they walked around and they chose what they wanted to do with that money. (P02, Interview)

Student behaviour. The last student factor identified as having an influence on teacher candidates teaching style choices, is their perceptions of students’ behaviour, particularly whether the students will be able to maintain control over their behaviours and behave appropriately if they implemented a certain teaching style. For instance, participant 2 expressed their fear about their student’s ability to stay focused when they reinforced the auditory modality: “I was first afraid to let the children discuss a lot because I was afraid, would the class get out of hand, would they actually be talking about what they are supposed to be talking about.”

Participant 2 also talked about how their perceptions of their students’ behaviours shaped their use of tactile and kinaesthetic teaching styles:

Even like that whole classroom store, I knew that that would be something that that class would be able to do behaviourally, and without it being a problem… I realise, I mean that group was great. There might have been 1 or 2 students that might get out of hand… But
I mean if it was a more difficult class I don’t know if I would have been as inclined to do that lesson or at least to that extent. (P02, Interview)

**Factors related to the classroom environment.**

*Resources.* One factor revealed during the data analysis associated with the classroom environment, which moulded teacher candidates’ perceptual teaching choices was the type and availability of resources. Many of the issues surrounding resources involved the accessibility of technology. Participant 2 and participant 6 described how the limited technology influenced their use of visual teaching styles:

My class didn’t have a smart board so I had to use an overhead projector which was a little difficult at times. Because of the lack of technology there, the overhead was horrible. Children at the back couldn’t see it. And I mean I was trying to avoid always using the board, but there weren’t a lot of options for me. (P02, Interview)

At the time they had a smart board but the Smart board was broken. I wanted to use the Smart board to show images of the shapes increasing or decreasing, or repeating patterns. So I ended up drawing on the board myself. (P06, Interview)

Similarly, participant 1 reported how technology helped them support visual learning in their classroom: “that classroom was set up really well because it had a smart board, and there was a laptop and I can just show kids a lot of stuff”.

Participant 2 also mentioned how the lack of other resources in the classroom, and their unawareness of the resources available in school, influenced their use of tactile and kinaesthetic teaching styles: “I didn’t know that they were available. I didn’t really know that there were a lot of manipulatives until later on because it was in a storage room with all the math things… If I knew about that earlier, I would have used more”. Furthermore, participant 5 also faced similar
problems with acquiring manipulatives to incorporate within their mathematics lessons: “I feel like this last placement, like in the classroom there weren’t that many like manipulatives. I don’t even think they had like a math resource like room or whatever. You know how like other schools have like a full set of different kits.”

**Associate teacher.** One factor, which is very important to state, is the influence of the associate teacher on the teacher candidate. Participant 2, participant 5, and participant 4 recalled how they felt the need to conform to the unchanging teaching style of their associate teacher:

This grade 4 teacher, I mean I completely respect his teaching style, and for him he was more write on the board. He would do it in fun ways, but he never really used any manipulatives. And I mean that works for him and the students and so I think because I entered his classroom I felt I sort of had to teach the way he did. (P02, Interview)

All of them are [all lessons are auditory] because that’s also the way that my AT teaches. He would like deliver the lesson by speaking at them for a good chuck o the time. And then, so I would just like mimic that. (P05, Interview)

I just feel like definitely the AT, it’s whether like you have flexibility in being creative; and so like my first and second placement sort of inspired me to be a little more creative, whereas this last placement, like he was very chill, and so I felt that way. (P04, Interview)

On the other hand, participant 3 explained how the characteristics of their associate teachers, facilitated the broadening of the teaching styles they employed in their lessons:

My second AT, she definitely wanted them to move around and do fun things with math or do different types of activities. My teacher really liked to do tactile things or where they are like moving around. Like I know that was one of her philosophies regarding math education. (P03, Interview)
Factors related to the teacher candidate.

**Knowledge in using resources.** Teacher candidates’ understanding of resources and how to incorporate them within their lessons is an aspect mentioned to affect teaching style choices. When discussing challenges to implementing perceptual teaching strategies, participant 5 expressed:

The hardest one to implement I would say is probably the tactile/kinaesthetic one. Cause they probably don’t know how to use the….well like I wouldn’t know how to use the manipulatives for certain units. Like for data management for like surveying I can only think of like pen and paper and like them walking around. Whereas like geometry, or like measurement, like you can totally get creative with that.

As voiced by participant 5, inadequate knowledge on how to expend resources, such as manipulatives, seems to hinder the use of tactile and kinaesthetic instructional methods. Likewise teacher candidate’s degree of comfort in using resources, such as technology, and managing potential complications that might arise is also an influencing variable. Participant 4 recalled:

One time the promethean board wasn’t working. All my lesson plans were done and when the promethean board didn’t work I almost had a panic attack… I had to remain calm and use other means and alternatives.

**Classroom management skills and openness to giving over control.** Teacher candidate’s perceptions about their own ability to manage the class shaped their instructional decisions. Participant 2 explained how they feared not being able to control the classroom when implementing a tactile and kinaesthetic lesson:

Part of it, I mean I was slightly scared that it would be hard to manage the class doing that whole store thing, but then I realise I mean that group was great. Their might have been 1 or 2 students that might get out of hand, but then again I was like this is a lesson that is expected to be loud because children are communicating and talking. So I learned to accept that. But I mean if it was a more difficult class I don’t know if I would have been as inclined to do that lesson or at least to that extent.
The last quote highlights the effects of, not only perceptions of classroom management abilities, but also teacher’s candidate’s openness to handing over some of the control to the students. Participant 1 too felt that this was an obstacle standing in the way of kinaesthetic instruction: “in terms of kinaesthetic, well there are, you are actually kind of letting go of classroom management control. So you know in that sense a teacher is taking kind of a risk”.

**Ability to determine learning style.** Participant 6 believed that the most difficult challenge for teachers was to accurately determine the specific learning style of each student: “Pin pointing if a kinaesthetic learner, or auditory, or visual. Because sometimes you can’t tell, they use all three.” This was a skill of a teacher, which they perceived to be an influence on teaching style choices.

**Ability to incorporate perceptual style.** Teacher candidates’ perceptions of their knowledge and skills in relation to implementing particular teaching styles effects the teaching strategies they select. It is not surprising that some teacher candidates show preferences towards those teaching styles that they feel more competent in delivering. For example, participant 1 when talking about their use of visual teaching strategies pointed out “it’s easy for me to show”.

**Constraints of time and effort.** Many teacher candidates agreed that attempting to incorporate all learning styles within every lesson required an implausible amount of time and effort on their part. Participant 6 proclaimed: “it is very difficult to match all students to your one lesson” and participant 1 asserted:

> For me I think it’s really hard to incorporate all 3 every day. So I attend to.. kind of one day I’ll focus on visual, one day I’ll focus on auditory, one day I’ll focus on kinaesthetic. Because I think, I mean, and some days I’ll use all 3. But again, to use all 3 every day is like, just really difficult. And I think that a teacher will probably kind of burn out if they did that for a long time” - Differentiating instruction based on learning style - requires lot of effort, incorporating all 3 really difficult, do different ones for different lessons.
Participant 5 also experienced time to be a challenging factor when trying to support the learning styles of all students in the classroom within each lesson. Particularly, they felt that practicum, given its brief 4-week-duration, didn’t give them enough time to learn about the particular learning styles of each student: “there is not enough time. Like you only have like a week to like really get to know them, and then like bam you’re in”. Time within the lessons also influenced the instructional strategies that were used by the teacher candidates. When participant 2 encountered a time crunch in lessons, they had to exclude pre-planned tactile and kinaesthetic minds-on activities: “there were some lessons that were very, I was limited on time so I just jumped straight to teaching them how to do it”.

Teacher candidates noted challenges to implementing specific perceptual strategies. For instance, participant 1 explained the added effort needed to integrate visual and kinaesthetic strategies within a math lesson: “visually, you have to prepare the material and, you know, there had to be a way to show kids the images or whatever you want them to do. There’s a lot of prep work”. They also pointed out how less effort required to include some perceptual styles, result in it being more frequently applied in lessons: “the easiest one is obviously, I think, auditory, because it’s you, just the teacher kind of talking. Whereas when you have to do visually, you have to prepare the material” (P01, Interview).

**Own learning experiences.** The personal early learning experiences of teacher candidates were another variable that affected the instructional styles they elected to employ when teaching in their practicum classrooms. One teacher candidate explained how their own positive learning experiences with teachers’ instructional style, influenced their perceptions of the importance of assimilating different learning styles to support student learning:

For me as I grew up, I learned more effectively when the teacher teaches to my style, even though the teacher doesn’t know she is teaching to my style. I learned it better that...
way. I found out that when I learn in a way that I engage I remember the material more and I understand the material more and when it comes to testing, I am more able to produce results or better results. And as a teacher I feel that we should teach that way as well. (P06, Interview)

While another participant explained how their own negative learning experiences with teachers’ instructional style, influenced their perceptions of the importance of assimilating different learning styles to support student learning:

I mean, even as we’re in this building, like… and like there’s not that many varied amounts of different teaching styles… I feel that there’s certain like obstacles that we face just with the teaching styles that are in OISE. And like I can kind of see a student, a younger student, being like oh this is really challenging because I am not really engaged. (P01, Interview)

Furthermore, participant 2 described how their early negative learning experiences with teachers’ instructional style, influenced their perceptions of the importance of integrating some learning styles more often (i.e. tactile and kinaesthetic) and some learning styles less often (i.e. auditory and visual) than they themselves encountered when learning:

I grew up learning just the teacher teaching you what to do on the board and that was it. So I tried to not do that. I mean I knew that at some point I had to write on the board because there are visual learners out there that need to see it on the board. But I tried to do whatever I could to sort of change that up.

**Teaching experience.** Participant’s teaching experiences also shaped their instructional decisions. Practicum was the most commonly cited experience by teacher candidates where they developed an understanding between instruction and different learning styles. Participant 4 described how this understanding affected the diverse teaching styles they employed in their latter practicum in comparison to their first:

My first practicum, it is still fairly new. It was actually my first time getting hands on experience with, I guess you can say, a diverse classroom. Because of that introduction mentality, my lessons were very teacher based not student based. It’s basically just me
standing up there as a lecturer. Majority of it was definitely auditory, but later on I started using more kinaesthetic. However, it was not until I got to my second practicum where I was like very versatile.

Participant 6 also mentioned their tutoring experience as one that assisted them when deciding which teaching styles to employ with particular students:

I had experience through tutoring as well. I tutor a lot of students. I have been tutoring for 9 years now. And because of that experience I was able to develop a skill where I can pick up different ways of how students learn.

Attitudes towards Differentiating Instruction Based on Student’s Learning Style

When questioned about differentiating instruction, all teacher candidates agreed that it was important to differentiate instruction based on student’s learning style. They also agreed that this definitely has an influence on student performance. More specifically, they asserted that students attain higher levels of achievement when their learning style is embraced in the classroom. However, most teacher candidates, 4 out of 6, strongly believed that it is more important to include all perceptual modalities within mathematics lesson rather than matching specific ones to specific students. They provided 4 reasons that support this perception:

Unidentified or changes in learning preferences. One reason teacher candidates provide for their view of incorporating all learning styles instead of specific student preferences is that it is a means by which they could discover the learning styles of students: “like we don’t know all the students’ learning styles unless we bring them into the classroom. So that requires that you get to know your students and bring in those different approaches as well”. Participant 2 supported this position by arguing that some students might not know or have discovered their learning style preferences and other students might have more than one learning preference:

One child might be able to say that they identify with one specific strategy but others might not have just one. Like me, I can learn using tactile stuff and visuals and I wouldn’t
want myself to be in one particular group, I would rather be taught the same way that everyone is being taught. I think it’s better to teach everyone using multiple different strategies.

**Promote student versatility.** Teacher candidates recognize varied instructional strategies to be the best, also because of their perception of its ability to make students versatile learners:

“balance because I want my students to be versatile as possible” (P04, Interview); “I mean we’re teaching them to sort of be able to adapt” (P05, Interview); “but I mean it is good if they are able to learn in multiple ways. And again by trying to teach every lesson by incorporating all the different learning styles, they have the opportunity to try and learn in the different ways” (P02, Interview); “like it’s to help them expand their horizons as well. And how can you like get better as a learner and we learn throughout our whole life. . I would want to build those in so that they can see that there are different types of learning” (P03, Interview).

**Future learning.** A final factor that was identified to be influencing teacher candidates’ decision to incorporate all learning modalities was their perceptions of student’s future learning environments and experiences. Participant 2, for instance said, “in the future they’re not just going to get one specific way to do anything. They’re going to have to learn how to accept the different strategies out there and get used to the different ways”. Participant 4 specified, “like when they get into the real world everything is not going to be like visual”. Similarly participant 5 expressed, “I guess in a sense like teachers are educating them so that they can be engaged citizens when they graduate. And so not everything is going to be like the way they learn once they graduate. So you definitely do need to um… teach them different ways of learning”, and added, “sometimes like those different ways could be their dominant way of learning later on, you never know.”

Thus it is not surprising that when teacher candidates were given a hypothetical scenario where a majority of their students (e.g. 80 percent) learned according to one particular learning
style (e.g. kinaesthetic), these four teacher candidates expressed that though they would definitely support the majority learning preference, they would not exclude the integration of other learning styles into their lessons. Participant 2 explained this pedagogical decision as one that derived from their desire to support every student in learning:

If I notice that, let’s say 80% of my class are visual leaners then I would definitely make sure that visual is always in my lessons. But that’s not to say that the other learning styles wouldn’t be in my lesson. I would make sure that specific ones that do come up will always be in my lessons regardless because I don’t want one student to not get what they need just because it’s the only child in the entire classroom with that learning style.

The other 2 teacher candidates, on the other hand, though they also acknowledged the importance of teaching students according to all perceptual modalities, expressed more of an inclination than the other four participants, towards teaching students according to their specific learning style preferences. For example, participant 1 answered:

It would be nice for me as a teacher to see them at least introduced to different learning styles. But if it’s not there, you know, we’ve tried a couple of times and if it’s obviously not something that … that their personality will allow… you know, I don’t want to force it on to the student. so I think that it’s more important that the teaching style matches the students learning style, rather than the student kind of being forced to embrace it all.

Likewise, participant 6 responded:

I think it depends on the student. I can’t tell the student to learn according to one style or three styles. It’s whatever is more comfortable for the student. But I don’t recommend to the student that because you are kinaesthetic learner, you should stick to being a kinaesthetic leaner, because learning evolves as we grow up and maybe even though now we are visual leaners, maybe the next day we are kinaesthetic learners. A student may discover a learning that they don’t know about. Neither do I tell them try to diversify yourself and learn in different ways. But I encourage to students to do whatever works best for you.

When these two teacher candidates were asked the same scenario question where a majority of their students preferred one particular teaching style, they mentioned, similar to the
other four participants that they would still try to incorporate all learning styles. However they also noted, unlike the other four participants, that they would use teaching styles that matched the majority preference more often than the other perceptual teaching styles. Participant 6 responded:

If 80% of my students are kinaesthetic leaners, then I must definitely, when I do lesson planning, I will try to ensure that I have more kinaesthetic. But at the same time I do not eliminate visual or auditory... Yes, it does affect my lesson a little bit because it will be geared towards more kinaesthetic, but it doesn’t affect it in a way that it will eliminate visual or auditory methods. I will always have all 3 in my lesson plans.

Relatedly participant 1 replied, "if I find that oh the majority of my class is a really visual kind of learner, then I would incorporate, like I would probably do like 80% visual 20% something else". They further explained, “like obviously if the kids are adapting well to different learning styles, then you know, I feel safer. You know, using different kinds of learning styles in the second semester. But if they are more comfortable and they learn better, it’s like why would I use a different learning style.”

Chapter 5: Discussion

Summary of Findings

The purpose of this study was to examine the factors that influence educators’ instructional style when teaching mathematics. The educators selected for this study were teacher candidates primarily because they were engaged in the process of developing their teaching style. Practicum experiences were designated to study teacher candidates teaching styles. Practice teaching has multiple purposes, one of which is to explore a variety of instructional methods and strategies within a classroom setting. Using a mixed methods approach, one-on-one interviews
were conducted with six teacher candidates, and quantitative and qualitative data were collected to help answer the research question. The data analysis revealed five key conclusions.

First, teacher candidates, overall used the visual teaching style most often, followed by the auditory teaching style, and least of all a tactical and kinaesthetic teaching style, however these differences were not significant. In other words, there are no differences in the amount of use of each perceptual teaching style by teacher candidates in their practicums when teaching mathematics. The four ways in which teacher candidates incorporated visual teaching strategies include: pictures, words and numbers, manipulatives and other objects, and technology. The four ways in which teacher candidates incorporated auditory teaching strategies include: teacher instruction, teacher and student questioning, group work, and whole class discussion. The five ways in which teacher candidates incorporated tactile and kinaesthetic teaching strategies include: interacting with objects, interacting with classmates, simulating real-life experiences, games, and physical activities.

Second, there was a significant difference between teacher candidates’ own learning style preference for auditory learning in comparison to the others. More specially, they revealed a higher preference for visual learning, tactile learning, and kinaesthetic learning over auditory learning. Though not significant, on average, teacher candidates preferred learning through the kinaesthetic modality, then the tactile modality, then the visual modality, and least through the auditory modality.

Third, there was no clear relationship between teacher candidate’s own learning style and their teaching style, except for the kinaesthetic modality. However, that relationship was negative - the higher the teacher candidate’s preference was for kinaesthetic learning, the less they employed kinaesthetic teaching strategies in teaching mathematics – further suggesting that
teacher candidates do not teach according to their own learning style preferences. Furthermore, through the qualitative data, it was revealed that teacher candidate’s own learning styles are only one piece of a group of factors that influence teacher candidate’s teaching style, and only affect some teacher candidates. This finding helps explain why teacher candidate’s own learning style alone did not reveal to have a significant relationship with their teaching style – they work in conjunction with a host of other variables that affect their teaching style.

Forth, the factors influencing teacher candidate’s’ teaching style can be organised into four groups. Some of these variables are associated with the lesson, such as the desire to foster real life experiences and connections, the unit of study, and the teaching styles used in other subjects. Another group of variables are related to the students, including the class composition, the grade level, the stage of students’ development and their ability to profit from the teaching style, perceptions of the level of engagement attained through the strategy, and behaviours of students in the classroom. While other factors center on the classroom environment, such as the resources available and their accessibility and influences of the associate teacher. A final group of variables are related to the teacher candidates themselves, including their knowledge and ability to use resources, ability to manage the classroom and openness to giving some control over to the students, ability to determine student’s learning style, ability to incorporate perceptual styles, constraints based on time and effort, understandings from their own learning experiences, and knowledge from their teaching experiences.

Fifth, most teacher candidates express an inclination towards embracing all perceptual modalities within their math lessons, more than towards matching the specific learning styles of students. The reasons they provide to support this position include: student’s learning styles might be unidentified or might change, it makes students more versatile by providing them with
opportunities to learn in new ways, and it prepares them for various learning environments they might encounter in the future that might not support their learning style preference. Only a minority proclaimed matching learning styles of students to be more important than teaching them through all perceptual modalities. However even this group expressed an affection for the latter.

**Connection to the Literature**

These findings are contradictory to past research that provide wide support that teachers teach the way they learn best, or in other words, according to their own learning style (Mehdikhani, 1983; Lyons, 1985). For example, Marshall’s (1991) study found that a substantial majority of teachers showed both a preference for learning and teaching by looking and listening, or visual and auditory learning. They also reported that a limited number of teachers asserted a preference for touching and doing, or tactile and kinaesthetic learning (Marshall, 1991). What’s more is that this study also revealed that the more a teacher candidate’s preferred kinaesthetic learning, the less they employed kinaesthetic strategies in teaching mathematics, further highlighting the limited effect of learning style in moulding teaching style decisions, and directing attention to the dynamics of other factors that work simultaneously.

However, similar to Marshall’s (1991) study with teachers, through the qualitative data it was discovered that personal learning style preference did affect some teacher candidate’s teaching style in this study. For instance, participant 5 stated, “I always had a visual. I’m a visual learner so I always need something to see”. However, personal learning style preference did not influence all teacher candidates and was only a piece of a whole cluster of other factors that together shaped instructional choices.
In addition, complementing Marshall’s findings, teacher candidates also reported that instructional strategies were sometimes selected due to their ease of use. As participant 1 expressed, “it’s easy for me to show”. Factors such as access to resources and restrictions due to time uncovered in this study, also embrace the “easiest way to cover material” answer given by Marshall’s participants.

Conversely, unlike Marshall’s findings, participants in this study did not mention that they taught the way they themselves were taught, or in other words the way they learned. Marshall (1991) explained that teachers in his study taught the way they learned because their early learning environments supported their learning style preference: “they had experienced a good match of environment, method, and learning style. And, reinforced by their successes within the system, they returned to continue this instructional pattern” (p. 226). Although having learned through “traditional” methods (i.e. visual and auditory), identical to Marshall’s participants, teacher candidates did not show a preference for these teaching styles over others. This is not surprising given that, unlike Marshall’s participants who were visual and auditory leaners, almost all participants in the present study, with the exception of one, had a major preference for kinaesthetic learning. According to Marshall’s suggestion, auditory and visual teaching style might not have been embraced in these teacher candidates in the same way, due to the absence of match in their early learning environments between their teacher’s teaching style and their own learning style.

Moreover, the higher levels of employment of kinaesthetic strategies by teacher candidates in this study, in comparison to Marshall’s, thus, are partially explained by their uncomplimentary learning experiences: “I grew up learning just the teacher teaching you what to do on the board and that was it. So I tried to not do that. I mean I knew that at some point I had
to write on the board because there are visual leaners out there that need to see it on the board. But I tried to do whatever I could to sort of change that up (P02, Interview).

Nevertheless, although teacher candidate’s used kinaesthetic and tactile strategies more frequently than Marshall’s participants, it is important to note that they did not show a preference for tactile and kinaesthetic teaching styles over auditory and visual teaching styles either. To help shed light on why these participants, unlike Marshall’s, did not teach the way they learn, we can turn back to Marshall’s explanations of his findings. In discussing his participants, he states, “in planning instruction, an assumption had been made: The way I learn is the way everyone learns” (p. 226). Consistently, Heimlick and Norland (2002) and Shavelson (1983) note that instructional practices of teachers are filtered through the beliefs and values the teacher holds. The belief that all students learn the same way, and more importantly, the belief that all students learn in ways that are identical to their own ways of learning, can guide a teacher’s decisions regarding their instructional practices.

Having said that, the results of this study are not unexpected, because the beliefs held by teacher candidates in this study are not analogous. Unlike the teachers in Marshall’s study that were aware of how their preference for auditory and visual learning increased their use of visual and auditory teaching strategies, some participants in this study reported that they used this awareness to prevent partialities in teaching. For example, participant 6 explains “I was aware of it. I have to make sure I don’t get into the bias of assuming everyone is like me. I don’t’ want to generalize and I don’t want my bias to take over and influence much of my lessons.” They further noted how their own learning experiences shaped their teaching style into one that did not promote their own learning preferences but rather those of their students:

For me as I grew up, I learned more effectively when the teacher teaches to my style, even though the teacher doesn’t know she is teaching to my style. I learned it better that
way. I found out that when I learn in a way that I engage I remember the material more and I understand the material more and when it comes to testing, I am more able to produce results or better results. And as a teacher I feel that we should teach that way as well. (P06, Interview)

Finally, many other factors - such as characteristics of the lesson (e.g. unit of study), characteristics of the students (e.g. demographics, behaviours, grade level), characteristics of the learning environment (e.g. resources), and characteristics of the teacher candidates (e.g. experience, knowledge, and skills) - were also identified in this study, distinct from other studies including Marshall’s, to have an influence on teaching choices. These factors, including participant’s own learning style preference, perceptual teaching style’s ease of use, and early learning experience, taken together provide us with a clearer picture of why teachers, especially today’s teachers, teach the way they do.

**Implications**

Several factors influence teaching style decisions; it is not influenced solely by teacher candidate’s own learning style preference. Findings from this research suggest that teacher candidates do not prefer one teaching style over another, as several influential variables, each promoting the use of distinct learning styles, are being considered when making instructional choices.

Even though this study was conducted with teacher candidates, the factors influencing instructional styles may be generalizable to full-time, practicing teachers, with the exception of one factor: the influence of the associate teacher. These findings are especially illustrative of modern day teachers because teacher candidates represent the most recent cohort of upcoming teachers. Therefore, these findings and their implications offer suggestions that would benefit
both teachers as well as teacher candidates in establishing an equitable classroom, through understanding and developing an awareness of how the factors identified in this study and surrounding them affect their instructional choices.

In order to help teachers better support students through reinforcing their learning styles with corresponding instructional strategies, the factors identified in this study must first be addressed in a variety of ways. For example, by providing professional learning around: the use of resource for implementing tactile/kinaesthetic lessons; how best to determine student learning style preferences; benefits of giving up control to students; how to effectively support different perceptual modalities. Another way might be through increasing the amount and types of resources available to teachers, such as manipulatives and technology. By addressing these factors, teachers, including teacher candidates, will acquire the knowledge, skills, and resources that will enable them to better support the learning styles of all students.

Although teacher candidates do not show a preference for any one teaching style over another, it is concerning that a majority of them believe that it is more important to teach students through all modalities rather than their specific preference, especially given that a vast amount of research provides support of the numerous benefits of matching teaching styles with student’s specific learning preference (Domino, 1979; Goodwin, 1995; Marshall, 1991). Therefore, this should also be addressed, through avenues such as teacher’s education, professional workshops, or staff meetings, in order for educators to comprehensively understand the importance and benefits of teaching students according to their preferred perceptual learning preference.
Limitations and Caveats

The current study has some limitations involving the sample and design that were applied. Certain characteristics of the sample might have biased the findings. The researcher selected teacher candidates to answer the research question. These teacher candidates might differ from the full-time teacher population. For example, many of the participants in this study identified as being highly comfortable in teaching mathematics. This might be a confounding variable that influenced the results, especially participant’s increased use of non-traditional instructional styles (i.e. tactile and kinaesthetic teaching styles), in teaching mathematics than revealed in past research.

Another characteristic of the sample is that it is composed of equal amounts of males as females. However, this isn’t a quality observed in the current teaching profession. More specifically, not 50% but rather a majority, 84%, of elementary school teachers in Ontario are females (Statistics Canada, 2006). In addition, full-time teachers might experience obstacles or other factors that affect instructional choices that teacher candidates are not subjected to, such as full year work load and addressing the concerns of parents. Thus, these results, especially the insignificant influence of learning style on teaching style and the negative relationship between participant’s kinaesthetic learning style and teaching style, might be ones not generalizable to full-time teachers.

There are also some limitations with the design employed in this study. Participants recalled teaching experiences that occurred during practicums. Practicums and full-year classroom teaching experience differ qualitatively – like previously mentioned obstacles such as increased work load and addressing the concerns of parents, are also factors attached to a full-year classroom experience that might not show up in one-month practicums. Practicums also
encompass other characteristics that deem them qualitatively different, including the presence of the associate teacher, which the present study revealed to have an influence on teacher candidates’ teaching style. For example, participant 4 described:

I just feel like definitely the AT, it’s whether like you have flexibility in being creative; and so like my first and second placement sort of inspired me to be a little more creative, whereas this last placement, like he was very chill, and so I felt that way.

Another limitation of the design is that participants provided their answers by recalling only one practicum experience. Conducting one-on-one interviews over a period of time, examining multiple practicums of teacher candidates, or following teacher candidates teaching style also after they attain a full-time teaching position, might yield different results. Taking these arguments into account, the utilization of a longitudinal method in future research appears valuable.

In addition, the responses to the one-on-one interview and perceptual learning style preference questionnaire might have been influenced by social desirability effects, especially given that participants were being interviewed by a classmate, thus lowering the probability of detecting a significant effect between learning style and teaching style. Therefore, future research should implement other measures, such as direct observation, as an alternative to, or as complementary to, the present research design.

The findings might also have been susceptible to interviewer bias. Expectations that the interviewer brings to the interview might affect the interviewer’s interpretation of the answers given by the participants, especially during the coding process.

The results of this study are also subject specific. The changes observed in educator’s teaching styles towards a mutual preference for all perceptual teaching strategies, might be one only applicable to math education. Furthermore, this might also explain why past studies, as a
result of examining learning styles across the curriculum or in other subject areas, report different findings.

This study included data that was correlational in nature and, as a result, conclusions about causal relationships cannot be drawn. For example, we cannot assert that a preference for kinaesthetic learning causes teacher candidate’s to infrequently use kinaesthetic teaching strategies; we can only state that these variables are related to one another.

Finally, but most importantly, this research only consisted of 6 participants. With 6 participants it is hard to determine significant effects and draw any strong conclusions. Therefore the findings of this research, including teacher candidate’s lack of preference for one teaching style or the non-existent relationship between teacher candidates learning style and teaching style, may possibly be due to limitations in sample size. This research with a larger numbers of teacher candidates, such as the 9000 teachers used in Marshall’s (1991) study, might reveal a significant positive relationship between teacher candidates’ learning style and teaching style.

**Future Research**

Given the limitations noted above, upcoming studies should employ a longitudinal design examining teaching styles over a period of time and using multiple methods of collecting data (e.g. interviews, observations, journals) to get a more reliable pictures of teacher’s teaching style. Future studies should also observe the teaching styles of recent teachers, teaching styles across different subject areas, and the relationship between teaching style and other aspects of student’s learning styles (e.g. social modalities, entailing whether student’s prefer to learn alone, in groups, with a peer, or with a teacher), and assess whether the results of this study are reproduced. Studies should employ multiple coders to increase the reliability of the findings by
tackling interviewer bias. In addition, with a larger sample size the possibility of detecting a significant effect is greatly improved, thus replications of this study should also include larger sample sizes.

Future research should also attempt to acquire a deeper understanding on the effects of each factor identified in this study to have an influence on teaching styles. Investigations should explore whether these factors act as mediating or moderating variables upon the relationship between teacher’s one learning style preferences and their teaching style. Changes to these factors should be implemented and/or observed to better understand their impact. This information can afford ways to assist teachers in more equitably supporting their students through embracing the learning styles of all students in their class.
References


Dunn, R.S., & Dunn, K.J. (1979). Learning styles/teaching styles: Should they ... can they... be matched? Educational Leadership, 36, 238-244.


doi: 10.1111/1467-8535.00173


Lam-Phoon, S. (1986). A comparative study of the learning styles of Southeast Asian and American Caucasian college students of two Seventh-day Adventist campuses (Doctoral


Appendix A: Interview Consent Forms
Letter of Consent for Interview

Date: ____________________

Dear Participant,

I am a graduate student at OISE, University of Toronto, and am currently enrolled as a Master of Teaching candidate. I am studying factors influencing teaching style in the classroom for the purposes of a graduate research project. I think that your knowledge and experience will provide insights into this topic.

I am writing a report on this study as a requirement of the Master of Teaching Program. My course instructor who is providing support for the research process this year is Mary Lynn Tessaro. My research supervisor is Donna Duplak. The purpose of this requirement is to allow us to become familiar with a variety of ways to do research. My research data collection consists of 30 minute interview that will be audio-recorded. I would be grateful if you would allow me to interview you at a place and time convenient to you, outside of school time.

The contents of this interview will be used for my research project, which will include a final research paper, as well as informal presentations to my classmates and/or potentially at a research conference or publication. I will not use your name or anything else that might identify you in my written work, oral presentations, or publications. This information remains confidential. The only people who will have access to my assignment work will be my research supervisor and my course instructor. You are free to change your mind at any time, and to withdraw even after you have consented to participate. You may decline to answer any specific questions. I will destroy the tape recording after the paper has been presented and/or published which may take up to five years after the data has been collected. There are no known risks or benefits to you for assisting in the project.

Please sign the attached form, if you agree to be interviewed. The second copy is for your records. Thank you very much for your help.

Yours sincerely,

Researcher name: Tharanky Balachandran
Phone number, email: 647-500-8254, tharanky.balachandran@mail.utoronto.ca

Instructor and Research Supervisor’s Name: Mary Lynn Tessaro and Donna Duplak
E-mail Address: marylynn.tessaro@utoronto.ca and donna.duplak@utoronto.ca
Consent Form

I acknowledge that the topic of this interview has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw at any time without penalty.

I have read the letter provided to me by Tharanky Balachandran and agree to participate in interviews for the purposes described.

Signature: ______________________________________

Name (printed): ___________________________________

Date: ______________________
Appendix B: Research Instruments

Perceptual Learning Style Preference Questionnaire (Copyright 1984, by Joy Reid. Explanation of learning styles was adapted from the C.I.T.E. Learning Styles Instrument, Murdoch Teacher Center, Wichita, Kansas 67208)

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>When the teacher tells me the instructions I understand better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I prefer to learn by doing something in class.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I get more work done when I work with others.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>I learn more when I study with a group.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>In class, I learn best when I work with others.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>I learn better by reading what the teacher writes on the chalkboard.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>When someone tells me how to do something in class, I learn it better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>When I do things in class, I learn better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>I remember things I have heard in class better than things I have read.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>When I read instructions, I remember them better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>I learn more when I can make a model of something.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>I understand better when I read instructions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>When I study alone, I remember things better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>I learn more when I make something for a class project.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>I enjoy learning in class by doing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FACTORS INFLUENCING TEACHING STYLE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>I learn better when I make drawings as I study.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>I learn better in class when the teacher gives a lecture.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>When I work alone, I learn better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>I understand things better in class when I participate in role-playing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>I learn better in class when I listen to someone.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>I enjoy working on an assignment with two or three classmates.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>When I build something, I remember what I have learned better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>I prefer to study with others.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>I learn better by reading than by listening to someone.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>I enjoy making something for a class project.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>I learn best in class when I can participate in related activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>In class, I work better when I work alone.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>I prefer working on projects by myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>I learn more by reading textbooks than by listening to lectures.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>I prefer to work by myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interview Questions

Introduction: My research question is: what are the perceptual – this is visual, auditory, tactile and kinaesthetic - learning styles and teaching styles of primary/junior teacher candidates and what factors influence the teaching style they adopt in teaching math. So basically, I want to learn about the teaching styles you used in your math lessons and what factors you feel influenced your selection of those teaching strategies?

Qualifier and Introductory Questions:
1) Have you taught math in practicum?
   a. What grades were they?
   b. What math units did you teach for each?
2) Have you taken any university courses in math?
3) What is your comfort level in teaching math?

Research Questions:
4) How often did you use visual teaching strategies (i.e. information through still and moving images) in math lessons? (Specifically, how much percentage of all math lessons included visual learning styles?)
   a. How did you incorporate visual learning in your lessons?
5) How often did you use auditory teaching strategies (i.e. information through listening and talking) in math lessons? (Specifically, how much percentage of all math lessons included auditory learning styles?)
   a. How did you incorporate auditory learning in your lessons?
6) How often did you use tactile and kinaesthetic teaching strategies (information through doing) in math lessons? (Specifically, how much percentage of all math lessons included tactile and kinaesthetic learning styles?)
   a. How did you incorporate tactile and kinaesthetic learning in your lessons?
7) Do you think your teaching style (i.e. the amount or way that you used that you used each strategy) differed between your practicums, and if so how?
8) What factors (e.g. personal, environmental, student, etc.) do you think influence the perceptual (visual, auditory, tactile or kinaesthetic) teaching strategies you used in your math lessons?
   a. Probing questions – what do you think affected your use of ______ teaching strategies more/less often than others?
9) Do you feel that there are challenges to implementing particular teaching styles, and if so what are they?
10) What are your views about matching learning styles to teaching styles, specifically do you think it is important to teach student’s according to their learning style?
    a. Did you differentiate math instruction according to student’s learning styles in your practicum, if so how?
    b. Do you think it affects student performance, and if so how?
11) Do you think it is more important to teach students to embrace all learning styles?
12) When you have a class of your own, would you learn about and address your student’s learning styles and if so how?
Appendix C: Participant’s Raw Scores

Raw Scores of Teaching Style of Teacher Candidates

<table>
<thead>
<tr>
<th>Perceptual Modality</th>
<th>Visual</th>
<th>Auditory</th>
<th>Tactile and Kinaesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>95</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Participant 2</td>
<td>100</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Participant 3</td>
<td>70</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>Participant 4</td>
<td>50</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Participant 5</td>
<td>100</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Participant 6</td>
<td>60</td>
<td>60</td>
<td>70</td>
</tr>
</tbody>
</table>

The scores are a percentage values that represent the amount of time teacher candidate’s report was devoted to the particular perceptual teaching style within all mathematics lessons taught in their practicum.

Raw Scores of Learning Styles of Teacher Candidates

<table>
<thead>
<tr>
<th>Perceptual Modality</th>
<th>Visual</th>
<th>Auditory</th>
<th>Tactile</th>
<th>Kinaesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant 1</td>
<td>38</td>
<td>32</td>
<td>48</td>
<td>42</td>
</tr>
<tr>
<td>Participant 2</td>
<td>48</td>
<td>32</td>
<td>48</td>
<td>46</td>
</tr>
<tr>
<td>Participant 3</td>
<td>42</td>
<td>36</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>Participant 4</td>
<td>26</td>
<td>28</td>
<td>40</td>
<td>44</td>
</tr>
<tr>
<td>Participant 5</td>
<td>36</td>
<td>24</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Participant 6</td>
<td>48</td>
<td>26</td>
<td>44</td>
<td>38</td>
</tr>
</tbody>
</table>

According to the Perceptual Learning Style Preference Questionnaire (1984) developed by Joy Reid and used in this study to collect the data on participants learning style preference, scores from 0-24 are negligible, scores between 25-37 represent a minor learning style preference, and scores between 38-50 represent a major learning style preference.