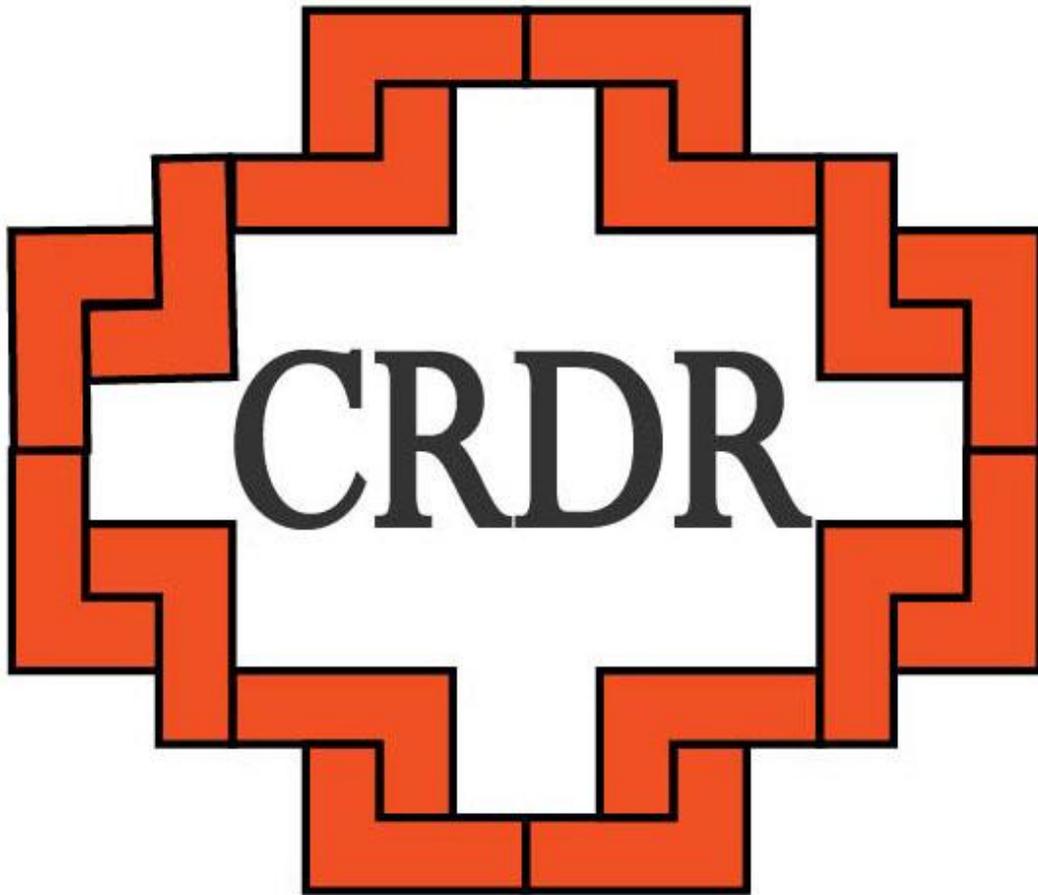


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**Contemporary  
Research in  
Disability and  
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Editor:

Dr. Saara Grizzell

University of Texas Rio Grande Valley

Associate Editors:

Dr. Roy Chen and Dr. Veronica Umeasiegbu

University of Texas Rio Grande Valley

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## From the Editor

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### Editor's Introduction to This Issue

Saara Terry Grizzell  
University of Texas Rio Grande Valley

On behalf of my co-founders and editorial colleagues, Dr. Roy Chen and Dr. Veronica Umeasiegbu, I am pleased to present the next issue of *Contemporary Research in Disability and Rehabilitation* (CRDR).

This issue contains two articles. In the first article, *Motivators and Factors for Career Decision-Making in Speech Language Pathology Students*, Dr. Ruth Crutchfield and colleagues present original research on the motivators and factors contributing to the career decision-making process of 106 graduate and undergraduate students enrolled in a Communication Sciences and Disorders (COMD) program. Survey results via descriptive statistics indicated that most COMD students were motivated to resolve difficult situations, help others, and to view situations holistically. Interestingly, findings indicate that the majority of students preferred and were motivated to learn more efficiently with visual and hands-on training. In addition, student organizations were found to play an important role in motivating students to explore their chosen career path.

In the second article, *Embodiment in Early Development: Exploring the Relationships between Sensorimotor Skills, Gesture, and Language*, Dr. Jessica Stewart and colleagues report findings from a study they conducted examining the relationship between sensorimotor abilities, gesture, and language in a sample of 54 infants and toddlers with typical developmental histories ages 9 to 15 months. Researchers administered the Mullen's Scale of Early Learning (MSEL), as well as obtained and coded two gesture samples from each participant. Sensorimotor skills were found related to gesture and expressive language, but not to receptive language. Regression analysis also revealed that visual reception was most highly related to gesture, whereas gross motor skills were found most highly related to expressive language. As these skills play a key role in typical language development, these findings could assist researchers and clinicians in future clinical decision making.

With that being said, I hope you enjoy this publication of CRDR.

Sincerely,

Saara Terry Grizzell, Ph.D., CRC, LVRC, LCDC  
Editor, CRDR

## Article

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### **Motivators and factors for Career Decision-Making in Speech Language Pathology Students**

Ruth Crutchfield, SLP.D., CCC-SLP  
University of Texas Rio Grande Valley

Adriana T. Gomez, B.S.  
University of Texas Rio Grande Valley

Zacarias Olivarez, B.S.  
University of Texas Rio Grande Valley

Celeste N. Gonzalez, B.S.  
University of Texas Rio Grande Valley

Alyssa L. Anglin, B.S.  
University of Texas Rio Grande Valley

#### **Abstract**

Career decision-making is a strenuous process that requires an individual to research and determine if the ends of the profession justify its means. Specifically, if the vocation of interest meets specific standards set by an individual. Literature review findings revealed eight subtopics that were salient: influencers/role models, demographics, perception of the profession, social belonging, personality type, curriculum approach, clinical experience and sense of urgency. To achieve an understanding of Communication Sciences and Disorders (COMD) student's motivators and factors for career decision making, a survey was administered which consisted of 37 questions composed of inquiries regarding demographics, decision making and self-efficacy. Analysis of the data revealed a strong tendency for COMD students to be problem solvers that are not easily deterred by difficult situations which was identified as motivator for the survey participants. Overall findings revealed COMD students have a general feeling of wanting to help others and can view the situation and person holistically which leads them to the COMD field. Additionally, this investigation in minority students also identified literature correlates for the salient subtopics of influencers/role models, demographics, social belonging, personality type, curriculum approach, clinical experience and sense of urgency.

*Keywords:* Career, Decision-Making, Speech Language Pathology, Motivators

## Introduction

Career decision-making is a strenuous process that requires an individual to research and better determine if the ends of the profession justify its means. Specifically, if the vocation of interest meets specific standards set by an individual. Some examples include lifestyle priorities such as beneficial outcomes and academic opportunities. Furthermore, the algorithm behind the thought process of solidifying a decision is also influenced by numerous of other factors. For example, choosing a career may be influenced by an individual's temperament; or their current worldview such as familial support, personal interests, demographics, and social environment (Dhima et al., 2013; Kember et al., 2008; Lyons et al., 2018). In fact, according to Zimmerman and Kontosh (2007), there are various intra-personal factors that impact career developing including and not limited to self-concept, gender, values, health, personal beliefs, age, and ability.

## Literature

Regarding influential factors, Brodsky, and Cooke (2000) argued that there are many factors that could influence career decision-making. The authors conducted a survey that analyzed the influential factors that impact career decision-making amongst undergraduate students. They focused primarily on students in the Communication Sciences and Disorders program who are inclined towards speech pathology and audiology. Moreover, the undergraduate students of the program, focusing primarily on speech language pathology, tended to rate personal factors as their greater influence in favor over educational influences. Conversely, undergraduates that demonstrated an interest in audiology identified as having significant interactions with professionals of the field that influenced their career decision-making (Brodsky &

Cooke, 2000). It was also evident that no sole factor determines a person's career decision making; rather, a combination of factors that influences whether the student will utilize information they acquire in the program to determine their perceived opinion.

Prior to determining a professional occupation, individuals may experience events during their childhood that can predetermine vocational decisions even before they reach adulthood. In addition, it is crucial for students to be exposed to a variety of occupations and have access to positive role models. Zimmerman and Kontosh (2007) postulated that support from the family is a vital factor in an individual's career decision-making. It was also shown that siblings play a crucial role in emotional support, social integration, esteem support, and information support. When considering emotional support, siblings provide encouragement to one another when choosing a career path. Social integration refers to siblings discussing who they are, their place in the world, and what they want to do career-wise. Esteem support as defined by Zimmerman and Kontosh (2007) is the kind of support that is given when a person is provided encouragement, motivation and confidence by family and friends. Esteem support is indicative of a sibling's confidence in their brother or sister's choice of career path. Information support signifies when siblings give advice from their past life experiences. Moreover, this article also suggested that older siblings were more likely to influence their younger sibling, as opposed to the younger sibling influencing the older one.

Overall, career decision-making has shown to be influenced on many complex factors that are unique to each individual. People that are considering pursuing a higher education are motivated by interpersonal and intrapersonal aspects in their lives such as locus of control or home life. However, the

amount of priority amongst said influences vary amongst each person and as such may impact their future career path. Literature findings revealed several factors that impact a person's careers decision-making such as influencers and role models, demographics, social belonging, personality type, curriculum approach/clinical experience and sense of urgency.

### **Influencers and Role Models**

Influencers and role models were identified as individuals and factors that impact and influence students during the crucial time of choosing a career. These could include family and friends (Kinnunen et al., 2018; Synder et al., 2014), peers (Garvey et al., 2009), program directors, teachers, university faculty and staff (Heflinger & Doykos, 2016). Minority students were reported to be influenced by family, family expectations (Yazici & Yazici, 2010), money, knowledge of secondary or post-secondary education (Baykal & Altuntas, 2011; Blackburn, 2011; Byrd et al., 2011; Chong & Ahmed, 2015; Martinez, 2018). External factors such as commitments in personal lives that affect how students engage in their academic careers were found as factors that dictated a student's performance in a university setting. This along with cultural and ethnic identities of the student also dictated a student's performance in a university setting (Kember et al., 2008). Females in the medical field were more likely to give up or pause their professional goals in order to raise children (Drinkwater, et al., 2008). Paternal instincts greatly determined the course of a female student's academic career according to Saele et al. (2016).

### **Demographic Indicators**

Various general demographic indicators of individuals who are in a career decision-making state were identified in the literature. Income was identified as factor in the aspect of the potential for earning and how that

would impact socioeconomic status (Boudarbat & Montmarquette, 2009; Schmidt et al., 2014; Yazici & Yazici, 2010). Gender played a role in decision-making as some fields present with a specific gender dominance (Akar, 2012; Boudarbat & Montmarquette, 2009; Drinkwater et al., 2008; Samra, et al., 2013). Self-efficacy which includes how a person believes in themselves and their ability to accomplish a goal was strong factor (Khasawneh, 2010; Thungjaroenkul et al., 2016). Race and ethnicity have also been found to be an obstacle when pursuing higher education (Byrd et al., 2011, Harkness et al, 2011). Finally, location of the university was at times prioritized over reputation of the university (Harkness et al., 2011) for some individuals when deciding to pursue their career.

### **Personality Types**

Personality types have a two-fold component – extrinsic and intrinsic. Extrinsic motivators include how the profession is perceived and the lifestyle that it could provide. Literature findings were varied. Amini et al. (2013) described how having a comfortable lifestyle was a driving force in deciding a career. Dhima et al. (2013) described how the work environment and the pace were powerful factors. Early exposure to the profession was another factor identified as crucial in solidifying a career choice (Dhima et al., 2013; Wiesenfeld, 2014). Various studies found that the variety of job opportunities available was a draw for some individuals as well (Blackburn, 2011; Dhima, et al., 2013). The scientific component of the health care profession was either a draw or a deterrent for some (Burgoyne et al., 2010). Intrinsic motivators are personal and individualized; however, the largest concept identified was that the profession has at its core helping others making it a gratifying and joyous job were

themes repeatedly identified by researchers (Akar, 2012; Dhima, et al., 2013).

### **Social Belonging**

Social Belonging includes the societal influences which contribute to student's career interest and how their beliefs correlate to their career path. For some, having a place and belonging in society, whatever those details are in their immediate surroundings were key factors in how they chose their career (Akar, 2012; Nystom et al., 2008). On the other hand, personal views such as their own personal experiences and the reports and experiences of others in the profession were also significant factors identified by multiple researchers (Drinkwater, et al., 2008; Neilson & Jones, 2012; Pop & Turner, 2009; Thomas, 2012). The manner in which society orients towards the profession or career of choice was identified as a factor by (Cheung and Arnold, 2014). Achievement motivation and how a person's goals can align with societal expectations were identified as factors by Blackburn (2011) Harkness et al, (2011) and Yazici & Yazici (2010). The level of empowerment that the profession provided was noted as a factor for both genders (Jones et al., 2016; Samra et al., 2013; Mishra et al, 2014). Involvement in Organizations (e.g., NSSLHA) and coherent classroom environment among teachers, students, and the university itself, was identified. These two components increase the sense of belonging, motivation, and create a higher feeling of connection amongst peers (Kember et al., 2008; Keshishian & McGarr, 2012; Martinez, 2018).

### **Curriculum Approach and Clinical Experience**

Curriculum approach is the manner in which the academic coursework was offered which includes varied clinical experiences. These were identified as factors for career decision making by various authors. Weisenfeld (2014) found through

quantitative study that prospective students accessed campus tours and interviews when searching for universities. Advisement was identified as being crucial for either deterring or promotion a career (Byrd et al., 2011; Drinkwater et al, 2008; Greenback, 2014; Kinnunen et al., 2018). Faculty expertise was also marked as a key component. Prospective students search for faculty who had a proven academic and professional record (Heflinger & Doykos; 2016; Keshishian & McGarr, 2012, Kinnunen et al., 2018; Neilson & Jones, 2012; Veerapen & McAleer, 2010). Practical instruction was identified as a strong factor as students preferred hands-on instruction and clinical experience to put to practice what they are learning in their lecture courses (Dhima et al., 2013; Konting, et al., 2009; Walker, 2008; Samra, McGrath, & Estes, 2013). Research assistantships fall under this category as they provide students with hands-on learning and income (Kontig et al., 2009).

### **Sense of Urgency**

Multiple factors promote a sense of urgency in many students when making a career choice – age, maturity, program length, motivation, and feasibility of program completion in a timely manner. Some researchers proposed that age also contributed to a student's beliefs/perceptions for outcome expectation – one of the key components towards career development. Age and maturity were also noted to be key when making decisions (Byrnes; 2018; Samra et al., 2013). Once maturity is reached, students move with confidence in making their career choices (Drinkwater et al., 2008). Students near the end of their studies experience a sense of urgency making them feel they must choose a career immediately (Cheung & Arnold, 2014, Greenback, 2014). Vermeulen & Schmidt (2008) stated student's motivation and persistence is based on two factors: feasibility of completing their program and granting the ability to get a

degree within the amount of time allotted. In other words, their perseverance is greatly influenced by the time given for the completion of the degree. Sometimes the program length can discourage a student to seek higher education.

The purpose of this study was to identify which factors are the main factors contributing to the decision-making process for students seeking a degree in Communication Sciences and Disorders (COMD). The following were the research questions:

1. Are there specific personality factors that contribute to career-decision making?
2. What are the motivators for COMD students to continue their educational pathway in a program with such a competitive market?
3. Do those motivators remain the same across the educational pathway?

### **Methodology**

A generalized survey by Schwarzer and Jerusalem (1995) was accessed and modified from the World Health Organization regarding self-efficacy in choosing a career. The survey was administered to 106 students at the graduate and undergraduate level and consisted of 37 questions which took approximately 15-20 minutes for students to complete. The first portion of the survey consisted of a consent script which provided a summary of the survey; and, it required participants to select if they would like to participate in the survey or decline from participating.

The initial portion of the survey pertained to the participant's demographics including age, gender, ethnicity, marital status, and possible number of children. Survey questions then progressed to obtain information related to education: including classification, Grade Point Average (GPA), parent education, financial aid, declaration of major as well as possible changes of major.

The third and final tier of questions pertained to decision making and self-efficacy questions. These questions included Likert scale options in which the participant was able to choose the answer that was most relevant to them.

Participants were administered a hard copy of the survey. Inclusion criteria for participation in this survey were 1) participants must be at least 18-50 years old, and 2) participants must be enrolled in an undergraduate or graduate program in COMD program. A total of 106 individuals participated in this study. The majority of the participants were female ( $n = 99$ , 93%) and self-identified as Hispanic ( $n = 100$ , 94%). The largest group was 18-24 years old ( $n = 87$ , 82%) followed by 25-34 ( $n = 16$ , 15%) and finally 35-44 ( $n = 1$ , .009%). The majority of the participants were single ( $n = 93$ , 88%) while only 9% ( $n = 10$ ) stated they were married. Ninety-four percent of the survey participants ( $n = 100$ ) stated they did not have children. Undergraduate groups were represented in the following manner from the largest to the smallest group: Seniors 38% ( $n = 41$ ), Juniors 30% ( $n = 32$ ), Sophomores 7% ( $n = 8$ ), and Freshman .009% ( $n = 1$ ). Graduate students had a larger representation of second year students ( $n = 23$ , 21%) as opposed to firsts year students ( $n = 1$ , .009%).

Once participants completed the survey, it was submitted anonymously to the research assistants. Through compilation of significant data, the participant's frequency of responses was then analyzed. The data collected was analyzed for descriptive statistics.

## **Results**

### **Student Data**

In regard to GPA, the majority of the participants reported being in the 3-3.6+ range ( $n = 51$ , 48%) when they were in high school. Coincidentally, university GPAs

were similar for the majority of the participants as 44% ( $n = 47$ ) reported having overall GPAs in the 3-3.6+ range and 43% ( $n = 46$ ) reported having a GPA in the major in this same range. The majority ( $n = 95$ , 89%) of the participants reported receiving financial aid, received Pell grants ( $n = 60$ , 56%) and received student loans ( $n = 57$ , 53%) to fund their education providing an indicator of student's socioeconomic status (SES). Finally, the majority of the participants were second generation college

students ( $n = 61$ , 58%), followed by first generation ( $n = 35$ , 33%), then third generation ( $n = 9$ , 8%) and lastly fourth generation ( $n = 1$ , .009%). Table 1 includes a summary of the descriptive statistics for the results and data referencing decision-making influences, considerations during decision making, logical or analytical, working styles, social surroundings, types of learners, ability to explain complex matters and self-efficacy which are described in the next section in narrative form.

Table 1

*Summary of Descriptive Statistics by Salient Categories*

	Total	Percentage
<b><i>Decision-Making Influences</i></b>		
Values their own feelings	35	32
Considers the effect on others	25	23
Attempts to avoid but succumbs	24	22
Remains objective	21	20
Does not make considerations in decision-making	3	3
	108	100%
<b><i>Considerations During Decision Making</i></b>		
Narrow down options	50	46
Decisive but continue to weigh options	31	29
Leave options open	12	11
Makes decision quickly	10	9
Has a hard time making decisions	5	5
	108	100%
<b><i>Logical or Analytical</i></b>		
Able to step back and see the big picture	69	65
Logical, but sensitive to others needs	22	21
Logical and analytical	9	9
Sensitive and excludes logic	5	4
Does not believe in logic or analysis	1	1
	106	100%
<b><i>Working Styles</i></b>		
Practical, hands-on workers	37	35
Idea person/needs quiet to focus	32	30
Hands-on workers who comes up with ideas	34	32
Idea person	3	3
	106	100%
<b><i>Social Surroundings</i></b>		
Balancing observing and listening	56	53
Preferred listening and at times witnessing	37	35

Choose to solely listen social surroundings	5	5
Only observe	5	5
Favored remaining oblivious	3	2
	106	100%
<b><i>Types of Learners</i></b>		
Mixture of visual and hands-on training is preferred	89	82
Learn by viewing diagrams and pictures	10	9
Occasional photo/diagram is helpful	4	4
Learning is a struggle	3	3
Learns by completing experiments independently	2	2
	108	100%
<b><i>Ability to Explain Complex Matters</i></b>		
Sometimes able	72	68
Able	23	22
Uncomfortable	8	8
Never able	3	2
	106	100%

### Decision-Making Influences

In the area of decision-making influences, of the 106 students participating in the study, two recorded that they consider two decision factors instead of one changing the total responses to 108. The majority of the respondents ( $n = 35$ , 32%) stated they value their own feelings and the effects the decision might have on others when making a specific decision the most. In contrast, only 3% ( $n = 3$ ) stated they did not consider much of anything when deciding for their career path. Twenty-three percent ( $n = 25$ ) of the participants considered the effect their decisions would have on others but ultimately did not allow others to influence them. Twenty-two percent ( $n = 24$ ) of the respondents stated they try to avoid feelings when it comes to judging decisions but succumb to their feelings in the process. Finally, 20% of the participants ( $n = 21$ ) stated they remained objective instead of letting feelings and others influence their decisions.

### Considerations During Decision Making

When asked about the types of considerations that were made when making a career decision, the respondents provided the following. The majority of the participants ( $n = 50$ , 46%) prefer to narrow

down the options they consider best in a certain situation whereas only 11% ( $n = 12$ ) like to leave their options open upon decision making. It was also found that 29% ( $n = 31$ ) of the respondents are decisive but continue to weigh options until the time came to act. Only 5% ( $n = 5$ ) of the participants had a hard time making a decision and were dependent on others deciding for them while a total of 9% ( $n = 10$ ) of the respondents revealed they come down to a decision quickly to move on to what is next. This question provides a clearer understanding of what influences students to make career decisions.

### Logical or Analytical

A majority of the participants ( $n = 69$ , 65%) stated they were personable and sensitive but were able to step back and see the big picture as well. Twenty percent of the participants ( $n = 22$ ) stated they were logical, but also were sensitive to others needs. The remaining options were chosen by 14% ( $n = 16$ ) of the respondents.

### Working Styles

A total of 35% ( $n = 37$ ) reported they were practical, hands-on workers. Thirty percent of the participants ( $n = 32$ ) considered themselves an idea person who sometimes finds it easier to be quiet and focus on work while 32% ( $n = 34$ ) felt they were

hands-on workers who come up with the occasional idea at times.

### **Social Surroundings**

Fifty-three percent ( $n = 56$ ) of participants enjoyed balancing the use of observing and listening when being involved in a social occasion. A sum of 35% ( $n = 37$ ) of the participants claimed they preferred listening and at times witnessing what was happening in their environment. Furthermore, 5% ( $n = 5$ ) of participants felt inclined to choose that they solely listen to their social surroundings, as opposed to 5% ( $n = 5$ ) of participants who favored to only observe those around them. Only 2% ( $n = 3$ ) indicated they favored remaining oblivious to their social environment.

### **Types of Learners**

Although there was a total of 106 participants, two of the participants selected two options instead of just one. The majority ( $n = 89, 82\%$ ) found that they like classes that mix visual and hands-on training. Nine percent of students ( $n = 10$ ) prefer to learn by viewing diagrams and pictures. The majority of communication disorder students stated it was more beneficial to them to learn academic content when it is presented through hands-on teaching and visual teaching. SLP's use numerous activities that involve visual learning and hands-on learning, so it is very interesting to find that the students pursuing communication disorders also prefer these type of learning strategies.

### **Ability to Explain Complex Matters**

Sixty-eight percent ( $n = 72$ ) of participants felt they were only able to sometimes describe complex matters verbally. Only 22% ( $n = 23$ ) of participants felt they were always able to describe complex matters. Students who are uncomfortable describing complex matters

may avoid careers where complex matters must be explained to people frequently.

### **Self-Efficacy**

When asked if whether a problem could be solved if they tried hard enough, participant responses varied. Most of the surveyed students, ( $n = 56, 53\%$ ), responded that this statement was exactly true. On the other hand, 46% ( $n = 49$ ) of the research participants answered that this declaration was only moderately true. Only one (1%) student responded that this statement was hardly true. Participants were also asked whether they would utilize various means and ways to get what they wanted when faced with opposition. Of the students surveyed, 50% ( $n = 53$ ) answered that this statement was moderately true. Nine percent ( $n = 10$ ) answered that this statement was exactly true. In contrast, only 27% ( $n = 29$ ) and 5% ( $n = 6$ ) of the students responded that this statement was hardly true or not true at all, respectively. When asked about their ability to stick to and accomplish their goals, most of the students ( $n = 53, 50\%$ ) answered either that this proclamation was either moderately true or exactly true ( $n = 50, 47\%$ ). When asked about feeling confident to efficiently deal with unforeseen events, participants responded in the following manner: moderately true 58% ( $n = 61$ ), exactly true 36% ( $n = 38$ ) and hardly true 6% ( $n = 7$ ). When asked if they were resourceful when taking care of an unpredicted problem, the majority ( $n = 69, 65\%$ ) of students agreed that this statement is moderately true, while only 15% ( $n = 16$ ) of students answered that this statement was hardly true. Twenty percent of participants ( $n = 21$ ) believed that the presented statement was exactly true regarding their resourcefulness. The majority of the participants ( $n = 75, 71\%$ ) stated that most problems can be solved if enough effort is exerted. On the other hand, 27% ( $n = 29$ )

Table 2  
*Summary of Descriptive Statistics for Self-Efficacy Components*

	Total	Percentage
<b><i>Solving Problems if Trying Hard Enough</i></b>		
Exactly True	56	53
Moderately True	49	46
Hardly True	1	1
	106	100%
<b><i>Using Various Measures to Reach Goals</i></b>		
Exactly True	10	9
Moderately True	53	50
Hardly True	29	27
Not True at All	6	5
	106	100%
<b><i>Accomplishing Goals</i></b>		
Exactly True	53	50
Moderately True	50	47
Hardly True	2	2
Not True at All	1	1
	106	100%
<b><i>Efficiently Deal with Unforeseen Events</i></b>		
Exactly True	61	58
Moderately True	38	36
Hardly True	7	6
	106	100%
<b><i>Resourceful</i></b>		
Exactly True	21	20
Moderately True	69	65
Hardly True	16	15
	106	100%
<b><i>Exerted Effort equals Problem-Solving</i></b>		
Exactly True	75	71
Moderately True	29	27
Hardly True	1	1
Not True at All	1	1
	106	100%
<b><i>Coping and Staying Calm</i></b>		
Exactly True	40	38
Moderately True	50	47
Hardly True	13	12
Not True at All	3	3
	106	100%
<b><i>Using Various Solutions</i></b>		
Exactly True	38	36
Moderately True	65	61
Hardly True	3	3
	106	100%
<b><i>Finding Solutions when in Trouble</i></b>		
Exactly True	37	35
Moderately True	64	60
Hardly True	4	4
Not True at All	1	1
	106	100%
<b><i>Can Usually Handle Problems</i></b>		
Exactly True	54	5
Moderately True	47	44
Hardly True	5	4
	106	100%

of participants stated that this statement was moderately true. When asked to rate their coping abilities to stay calm when faced with problems, 50 (47%) of participants answered that this statement was moderately true. However, only 40 (38%) of participants answered *exactly true*. When asked about coming up with various solutions when met with a problem, a majority of the participants ( $n = 65$ , 61%), answered moderately true to this statement while 36% ( $n = 38$ ) of the participants answered exactly true. When posed with the question of whether they can come up with a solution when in trouble, more than half of the participants ( $n = 64$ , 60%), answered that this statement was moderately true. Only 35% ( $n = 37$ ) of the participants answered *exactly true*. Finally, 54 (51%) and 47 (44%) of the participants answered as moderately true or exactly true, respectively when asked if they can usually handle problems that come their way. Table 2 illustrates all Self-Efficacy findings.

## Discussion

### Influencers and Role Models

Regarding the centralized theme of whether students can maintain objectivity when deciding their career choice, or if other people served as a primary influence in their decision-making process multiple notions were identified. Findings support the notion that some COMD students' value not only their own feelings in the decision-making process, but some also consider how a decision is perceived by society. Furthermore, this identifies that a complex array of factors and influencers affect a student's career decision-making process. Societal influences can have a major impact on a student's choice of professional career. Akar (2012) stated that societal influences, such as parental figures and friends, played a role in the decision to pursue a certain career. The majority of the respondents ( $n = 35$ , 32%) stated they value their own feelings and

the effects the decision might have on others when making a specific decision the most. In this case, students are thinking about the effects that their decision will have on their parents who consistently play a crucial role of emotional and financial support during the pursuit of post-secondary education.

Career decision-making choices can be influenced by advice given to underclass students from those who have previously graduated. This also applies for students in the Communication Science and Disorders program, as revealed by Keshishian and McGarr (2012). Their study showed that students, in organizations such as the National Student Speech-Language Hearing Association (NSSLHA), were highly motivated to take an active role in their education. Interesting enough, research findings paralleled those of Keshishian and McGarr (2012). Findings revealed the majority ( $n = 93$ , 89%) felt inclined to listen and watch their social surroundings and favored listening and watching before making decisions. Students are influenced in some way by what their peers do or say; hence, the influence of a student organization.

### Demographics

Regarding the topic of demographics, sub-topics such as gender, income, and location influence the narrowing of options in the process of career decision-making. Of the individuals represented, 94% were females and the remaining 6% were males. Gender is a factor that sometimes narrows the careers a student thinks are best for them. In addition, studies have shown that women who were of childbearing age were more likely to be discriminated against in the search of vocational opportunities due to stigmatization of women being limited to a maternal role (Drinkwater et al., 2008, Viernes et al., 2018). Akar (2012) found that men were less likely to pursue a career in a female dominated industry, such as teaching,

to avoid negative implications against their sexuality. As opposed to men, women were more likely to consider the aptitude of their abilities in-order to better discern amongst their vocational options.

Moreover, social economic status (SES) is a factor that may influence students who are in the decision-making process of choosing a career. Students who come from a low social economic household may not have funds readily available to attend a college or university. The majority ( $n = 95$ , 89%) of the participants reported they received financial aid, Pell grants ( $n = 60$ , 56%) and student loans ( $n = 57$ , 53%) to fund their education. This could explain why some students choose a vocational institution where certifications are granted in a shorter amount of time for a lower cost of tuition. Boudarbat and Montmarquette (2009) found that graduate students' decisions concerning their academic career proved to be reinforced by their financial ability to pay for higher education. Moreover, non-traditional students proved to experience more difficulties when completing their degree at a university level due to their low socioeconomic status. In contrast to non-traditional students, traditional scholars who are financially privileged are more likely to receive fiscal assistance, such as scholarships right out of high school (Schmidt et al., 2014). In fact, Harkness, et al. (2011) indicated that SES and ethnicity prevailed as obstacles in-regards to easy college access for students.

### **Social Belonging**

Social Belonging, as mentioned previously, includes societal influences that contribute to student's career interest and beliefs which mold their career path. Survey participants ( $n = 93$ , 88%) indicated they listen to the opinions of their peers, within the same field of choice, their colleagues who may have selected to study a different profession, family members, and university

faculty. In fact, a research study conducted by Neilson and Jones, (2012) suggests that faculty members, such as academic advisors, who hold unfavorable opinions over a specific vocational field, may advise students to follow a different occupation and negatively influence students based on biased views. Thus, the student may choose to remain in their current choice of profession, or the student may leave it and pursue a career that's more socially acceptable.

Ninety-five percent ( $n = 101$ ) of the respondents agreed, either fully or moderately, that they could handle any task that comes their way. In contrast, the 5% ( $n = 5$ ) of students who feel they can hardly ever manage these tasks are the ones who might be at risk of developing negative emotions towards their field of choice which may result in a decrease of social belonging. In conclusion, the marginal percentage of students who were doubtful of their management skills may need additional services to preserve their sense of social belonging.

### **Personality Type**

When individuals find a career that is intrinsically motivating, they tend to pursue that career. In fact, Akar (2012) found that intrinsic career value, such as working in a job that makes a difference in someone's life, was one of the highest rated motivations. When asked about following their feelings, 32% ( $n = 35$ ) of the participants responded by saying they allow their feelings and the impact of their decision on others shape their final choice. Therefore, if a person enjoys helping others and enjoys the effects that their actions have on another person, then they are more likely to choose a career that caters to their passion. The majority of participants agree that they will consider not only their feelings when deciding, but also how the decision will affect those around them. They are compassionate and are willing to do what is best for those around

them, whether it be their family, peers, or their community. Greenbank (2014) affirms this idea by stating that these feelings will instinctively influence their decision on making a career choice. At the same time, a student's natural curiosity, attraction to the field of Speech Language Pathology, and the desire to help others may have also contributed to their decision of pursuing a major in COMD (Hren et al., 2010). Yazici and Yazici, (2010) affirmed that guaranteed employment and expected earnings in the field played a factor as student's selected a major. Students develop career aspirations and become aware of their strengths and weaknesses throughout their academic journeys. Ultimately, it is important to recognize that each individual student's personality type is inherently unique to themselves and remains a determining factor of career decision-making.

As far as participants being holistic in their decision-making, findings revealed 64% ( $n = 68$ ) of the students reported being able to see the big picture and still be personable and sensitive to the patient's needs. Considering that the surveyed population is seeking a career in Speech Pathology, a Speech Language Pathologist is someone who must be personable, sensitive, and logical when making their clinical decisions. Different types of students' personalities are depicted throughout the surveyed responses. Pop and Turner (2009) stated that students, who were pursuing a career in teaching, have a love for teaching-related activities. This statement resonates with students pursuing a major in COMD as they have passion for utilizing skilled intervention strategies to teach their patients. This supports our findings which revealed the majority ( $n = 89$ , 82%) of the participants learn more efficiently when the class has hands-on and visual learning.

An individual's intrinsic and/or extrinsic motives are the foundations for career

decision-making. The majority ( $n = 72$ , 68%) of the individuals are only sometimes able to explain complex matters verbally. Hren, et al. (2010) stated that students are intrinsically motivated because of their ambition and attraction toward the subject. Therefore, if a student is intrinsically motivated, they will feel comfortable explaining complex matters verbally. If students are properly educated on a major and what that career entails, then it can lead to easier decision-making. A similar belief can be found in a study done by Keshishian and McGarr (2012) as they identified that, the more an individual knew about a major, the more attractive it would appear to the individual. Therefore, if students understand and know the responsibilities they will be held accountable for then this will influence and lead to narrowing career choices that are the most suitable for them.

Ninety-seven percent ( $n = 103$ ) of participants either completely or moderately agreed they can accomplish their goals with ease. Results concur with Robinson and Glanzer (2016) who found that students who want to excel in a chosen field will work towards their goals regardless of intellectual challenges and requirements. The majority of the surveyed population were confident in overcoming obstacles. For example, 98% ( $n = 104$ ) of students agreed they could resolve difficult problems if they put in the effort, and 85% ( $n = 90$ ) of students agreed they were resourceful enough to handle unforeseen situations.

### **Clinical Experience and Curriculum Approach**

Clinical experience and its influence on a student's choice of career was identified in the literature as a salient topic. Samra, McGrath, and Estes (2013) believed that, through various clinical experiences, students can observe different career options that can promote career development. By allowing students to immerse themselves in clinical

experiences, the decision-making process might be easier as they place themselves in a real-time clinical setting with a working professional in their current or prospective career choice, thus supporting our findings of 82% ( $n = 89$ ) of survey participants indicating they prefer hands on and visual learning. Furthermore, internships allow for actual hands-on practice of the hypothetical concepts taught in class, ultimately leading to better-prepared students in terms of knowledge and experience (Kaşlı & İlban, 2013). Internships are consistently included in COMD graduate programs in the form of external practicums during the second year of graduate school and clinical practicum is implemented in many graduate programs since semester one of graduate school. This hands-on learning component would be a positive component for those students who prefer this learning mode. Additionally, Lyon et al., (2018) suggest having an exposure to a variety of environments and hands-on experience leads to a positive career decision-making and builds a strong relationship with superiors.

While not explicitly stated in the survey, one could associate a student's confidence in finding solutions to unexpected problems with the quality of services their university provides for them. In fact, 95% ( $n = 101$ ) of the surveyed population, demonstrated that there was either a moderate or absolute truth to their confidence in solving problems. In addition, Blackburn (2011) affirms this idea as he described that students tend to choose a university's program based on its available facilities and the quality of services it had to offer. Therefore, consideration should be given towards various factors such as the quality of services provided by a student's corresponding university.

### **Sense of Urgency**

Students in COMD programs, specifically the second-year undergraduate students, are actively contemplating career-

making decisions. Cheung and Arnold, (2014) concluded that students who are nearing graduation feel pressured by a sense of urgency to make decisive career choices. Since the largest number ( $n = 50$ , 46%) of the participants demonstrated a tendency to narrow down their options upon decision-making, it is possible that students consider the quality, the education, and the level of professionalism they have received from the undergraduate program to search for jobs or graduate programs.

### **Conclusion**

Multiple results showed a strong tendency for COMD students to be problem solvers that are not easily deterred by difficult situations. This is a significant finding in that students in the COMD program are resilient people committed to completing their professional goals thus providing the response to the first research question in reference to personality factors. Overall findings reveal students in the communication sciences and disorders profession have a general feeling of wanting to help others and are able to see the situation and person as a whole. This shows the type of student that is drawn to this profession. COMD students are composed of different types of learners: hands- on learners, visual learners, concrete learners, hard-workers, problem-solvers, and goal-oriented learners. Additionally, student organizations play an important role in providing the students with peers that motivate them to delve further in their chosen career path. Exposing students to clinical experiences reinforces a student's career decision-making. Thus, providing the answers to the second and third research questions regarding motivators.

Limitations of the study include the size and location of the participant sample. This survey was administered to a focused population in one specific COMD program in the southern-most part of Texas. It would be beneficial to extend the administration of the

survey to additional COMD programs across Texas and the nation to identify whether the same patterns parallel. A strength and a limitation of this survey is the inclusion of a focused survey population in that it was a minority (race and gender). It is a strength in that this investigation provides a unique view of the personality and motivation of students seeking degrees in Speech Language Pathology that had not been obtained prior to this investigation in a monitory population. It is a limitation because the finds are not generalizable to the general population.

It would be beneficial to expand this research in the future by including students from multiple health professions and diverse minority groups thereby identifying additional patterns of student pathways when searching for a career. University programs will continue benefiting from knowing what influences students and what students looking for when deciding on a career path.

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**Author Note:**

Correspondence for this article should be addressed to Ruth Crutchfield, Communication Sciences and Disorders, University of Texas Rio Grande Valley, 1201 West University Drive, Edinburg, Texas 78504, Email: [ruth.crutchfield@utrgv.edu](mailto:ruth.crutchfield@utrgv.edu)

## Article

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# Embodiment in Early Development: Exploring the Relationships between Sensorimotor Skills, Gesture, and Language

Jessica R. Stewart, Ph.D., CCC-SLP  
University of Texas Rio Grande Valley

Melissa Pierce, M.S., CCC-SLP  
Arizona State University - Tempe

Ruth Crutchfield, SLP.D., CCC-SLP  
University of Texas Rio Grande Valley

Debra C. Vigil, Ph.D., CCC-SLP  
University of Nevada - Reno

## Abstract

**Purpose:** This study examined the relationship between sensorimotor abilities, gesture, and language in prelinguistic typically developing children from an embodied cognition perspective.

**Method:** Participants included a total of 54 typically developing infants and toddlers between the ages of 9 months and 15 months. All participants were administered the Mullen's Scale of Early Learning (MSEL) and two gesture samples were obtained and coded. The MSEL was used to analyze sensorimotor and language abilities which were explored in relation to gesture.

**Results:** Results established that sensorimotor skills are related to gesture and expressive language, but not receptive language. Visual reception was most highly related to gesture whereas gross motor skills were most highly related to expressive language.

**Conclusion:** This study supports an embodied development perspective with sensorimotor skills relating to gesture and language development. We emphasize the need for interdisciplinary collaboration in treatment and assessment of children, considering the entire developmental profile.

*Keywords:* Embodied cognition, sensorimotor, language, gesture, development.

## Introduction

Examining a child's early development can provide a clear view about how the body and mind grow and mature. As a child masters each developmental milestone we can make predictions about the child's future abilities. Certain observable skills in early childhood are known to be associated with linguistic, cognitive, and motor outcomes. Gesture use, for example, is associated with later verbal language development (Rowe & Goldin-Meadow, 2009), babbling is predictive of first word onset (McGillion, 2017), and fine and gross motor skills are predictive of later language outcomes (Gonzalez et al., 2019). There is a connection between individual skills and their impact on later development; however, a need for continued exploration of the relationships between these developmental skills persists.

Although research investigating individual developmental skills in infants and toddlers is abundant, the mechanism through which their sensorimotor experience supports early development of these skills deserves further exploration. One explanation for this relationship is embodied cognition, a theory suggesting that an individual's sensorimotor experiences uniquely contribute to their overall skill development, including language (Lackoff & Johnson, 1980, 1999). Embodied cognition posits that the human mind and body are interconnected, and that many aspects of cognition, including language, are related to the body's sensorimotor interactions with the world at large.

The initial evidence motivating embodied cognition science includes four critical components. The first is that gesture is naturally used in conjunction with language. The use of gesture not only assists in communication but facilitates language processing (McNeill, 1992). Second, vision guides action and the feedback provided by movement impacts visual processing to some

extent (O'Regan & Noe, 2001). Third, the mirror neuron system is activated in response to an observed action (Rizzolatti & Craighero, 2004). The fourth and final exemplar for embodied cognition science draws from the fact that cognitive tasks such as recall and memory are assisted by using our body, movement, and the immediate surroundings to cue ourselves (Donald, 1991).

Embodied cognition concepts have primarily been tested via behavioral and physiological research on adults (Hauk et al., 2004) and older elementary school aged children (Adams et al., 2018; Berenhaus et al., 2014; Porter, 2012). Studies exploring these concepts in younger children are limited and could provide valuable insight into human development and how different systems interact during this process. This information is of great importance because understanding how sensorimotor abilities interact with the development of various cognitive processes, including gesture and language, provides valuable information about typical development and has the potential to guide clinical decision making.

## Gesture and Language Development

The relationship between gesture and language development is well established in the literature. (Bates & Dick, 2002; Bates et al., 1979; Werner & Kaplan, 1963). For example, gesture use at 18 months of age is predictive of vocabulary and sentence complexity at 42 months of age (Rowe & Goldin-Meadow, 2009), the content of first words spoken and symbolic gestures used is very similar in content (Bates & Dick, 2002), and early gesture use can predict early verbal vocabulary (Iverson & Goldin-Meadow, 2005), onset of two word combinations (Iverson & Goldin-Meadow, 2005), and later vocabulary competence (Rowe & Goldin-Meadow, 2009). In atypical populations, word production usually does not begin until symbolic gestures have appeared (Happe &

Frith, 1996; Singer-Harris et al., 1997). Children delayed in use of gesture may also be delayed in later stages of language development (Thal et al., 1997). While the relationship between gesture and language is clear, an area in need of further exploration is understanding how, or if, a child's sensorimotor abilities are related to the development of gesture and language.

### **Sensorimotor, Gesture, and Language Development**

Studies have examined the relationship between sensorimotor skills and gesture and language development in young children. While limited in number, these studies support that sensorimotor skills play a role in both the development of gesture and language. A series of studies conducted by Choi and colleagues (2018, 2019) found that fine motor skills, including speech production and hand movements, are predictive of later expressive language ability; one-year-olds' pointing, an especially predictive fine motor skill, is correlated with later language skills at ages three and four (Luike et al., 2019); and 6-9-month-old infants' gross motor usage of their arms is correlated with their vocalizations (Iverson & Fagan, 2004). Additionally, early onset of walking is predictive of language abilities at two years of age (Luike et al., 2019); babies' visual attention, when coordinated with their own vocalizations and gestures, is predictive of later expressive vocabulary (Donnellan et al., 2020); and joint attention, which relies on visual attention, mediates the link between language and motor development for typically developing siblings of children with ASD, a connection that reflects tenets of embodied cognition (Bruyneel et al., 2019). Taken together, these studies suggest that sensorimotor skills are an important component of young children's gesture and language development; however more

studies are needed to understand this relationship more deeply.

The goal of the current study is to increase understanding of the way specific sensorimotor skills correlate with gesture and language abilities. More specifically, an embodied cognition framework is used to interpret how visual reception, fine motor, and gross motor interact with gesture use and language development. Understanding this relationship is important because it provides researchers and clinicians with information about typical development. Furthermore, it has the potential to impact future clinical decision making and can support the need for multidisciplinary assessment and intervention of children. This study addresses the following research questions:

1. Is there a relationship between sensorimotor skills and gesture use in typically developing prelinguistic children?
2. Is there a relationship between sensorimotor skills and language abilities in typically developing prelinguistic children?

### **Methods**

The research questions for this study are original. The methodology and data were part of a larger research study conducted by the first and fourth author of this study (Stewart et al., 2021). Appropriate approval from the University of Nevada, Reno (UNR) Institutional Review Board (IRB) was obtained.

### **Participants**

A total of 54 typically developing children, 34 males and 20 females, between the ages of 9 and 15 months participated in this study. Participants were recruited from the following locations in northern Nevada: day cares, preschools, early learning centers, mothers' groups, doctors' offices, and churches. Inclusion criteria comprised of the following: a) children between 9-15 months

of age, b) passed newborn hearing screenings, c) no history of intervention services or previous diagnoses, and d) developmental profiles within normal limits. Information relating to hearing screenings and previous interventions and diagnoses were collected via parent report.

Developmental profile was assessed with the Mullen Scales of Early Learning (MSEL; Mullen, 1995). All subtests of the MSEL were administered by a licensed speech and language pathologist. See Table 1 for participant demographics.

Table 1  
*Participant demographics*

	Total (N = 54)
CA Mullen's (M (SD)):	11.37 (1.78)
CA Video (M (SD)):	11.59 (1.74)
Gender (M, F):	20, 34
Race	
Black:	2
Hispanic:	5
White:	36
Mixed:	11
Mother Education	
Beyond Bachelors:	12
Bachelors:	19
Associates or some college:	15
High School Diploma:	7
No High School diploma:	1
Not reported:	0
Father Education	
Beyond Bachelors:	9
Bachelors:	9
Associates or some college:	12
High School Diploma:	17
No High School diploma:	4
Not reported:	3

*Note.* CA = Chronological age in months; M = Mean; SD = Standard Deviation.

## **Instruments**

### **The Mullen Scales of Early Learning (MSEL)**

The MSEL is an individually administered comprehensive measure of cognitive and motor functioning for infants and preschool children from birth through 68 months of age. This standardized assessment has been determined to have good reliability and validity and consists of five subtests: Visual Perception, Gross Motor, Fine Motor, Receptive Language, and Expressive Language. The gross motor subtest assesses a child's central motor control and mobility; the visual reception subtest assesses a child's visual input decoding, oculomotor and visuomotor operations, visual discrimination, and visual memory; the fine motor subtest assess a child's fine motor coordination; the receptive language subtest assesses a child's understanding of verbal directions, auditory-spatial and auditory-quantitative concepts, memory for commands, and general information; and the expressive language subtest assess a child's ability to express various concepts through the use of spoken language.

Each subtest of the MSEL yields a raw score, which can then be transformed into a T-score and a percentile rank. The raw score obtained on each subtest can also be used to calculate an age equivalent. The mean T-score on the Mullen's is 50, with scores falling between 40 and 60 considered to be within normal limits or typically developing. Scores that fall above 60 are considered above average, whereas scores falling below

40 are considered below average. In addition to each subtest, the Mullen's provides an *Early Learning Composite*. This score is representative of an average of the child's performance on all subtests. The *Early Learning Composite* is calculated by summing the T-Score's obtained on the above five subtests. For the Early Learning Composite, the mean standard score is 100, with scores falling within the 85-115 range considered to be within normal limits. Scores falling above 115 are considered to be 'above average', whereas those falling below 85 are considered to be 'below average'.

### **Procedure**

In order to not interrupt the child's daily routine and accommodate the needs of the parents and/or caregivers, data collection took place in a quiet room at several different venues dependent on parent preference. These locations included: a) the child's home, b) the child's day care, preschool, or early learning center, or c) a university clinic. The following individual(s) were present during each session: parent/caregiver, teacher, investigator, and/or a research assistant(s).

Data collection took place across two separate sessions occurring within one week of one another, each approximately 45 minutes in duration. Session one consisted of obtaining consent, completion of the parent questionnaire, and administration of the MSEL. Session two consisted of the gesture sampling. See Table 2 for descriptive results from the MSEL.

Table 2

*Descriptive statistics from the MSEL*

	Total (N = 54; M, SD)
Gross Motor	
Raw Score	16.07 (3.19)
T-Score	54.07 (8.45)
Visual Reception	
Raw Score	17.28 (1.91)
T-Score	63.56 (8.05)
Fine Motor	
Raw Score	16.28 (1.89)
T-Score	62.19 (6.38)
Receptive Language	
Raw Score	14.94 (8.62)
T-Score	54.11 (6.93)
Expressive Language	
Raw Score	12.31 (2.35)
T-Score	51.87 (6.88)
Early Learning Composite Standard Score	116.43 (9.20)

\**Note.* The mean T score is 50 with a standard deviation of 10. The mean standard score is 100 with a standard deviation of 15.

***Session One***

The first session involved obtaining consent, completion of a parent questionnaire, and administering the MSEL. Informed consent was obtained from the parent or legal guardian of all participants that participated in this study. The parent questionnaire was also completed by the parent or legal guardian of the participants and collected demographic information and basic developmental histories. A licensed speech and language pathologist, administered all five subtests of the MSEL to all potential participants. If a participant obtained scores within normal limits on all five subtests of the MSEL a time was scheduled for the second session, gesture sampling, to be conducted. If a participant obtained scores below normal limits on any

of the subtests of the MSEL concerns were discussed with the parent or caregiver and the appropriate referral(s) was made. Subsequent to assessment, parents were provided with a report outlining the results of testing.

***Session Two***

The second session involved gesture sampling. The procedure for gesture sampling was adapted from Wetherby et al. (1988) and consisted of obtaining two video recordings: an unstructured observation and a structured observation. A combination of structured and unstructured procedures is the best way to accurately sample communication in young children (Wetherby & Rodriguez, 1992). Observing a child in an unstructured setting allows for the child to behave in a naturalistic manner; however, does not always allow for the child to display the full range of communication the child is

capable of. Observation of a child in a structured setting allows the clinician or experimenter to create opportunities for the child to engage in communication. Both observations were approximately 15 minutes in duration.

The unstructured observation always occurred first in order to allow the child to acclimate to the interactant and/or setting. For this observation, the interactant was a research assistant or investigator. The child was allowed to play with a minimum of five of the following toys across a fifteen-minute time span: ball popper, book, pop tube, ball and hammer toy, bubbles, star stacker, and an interactive ball. The interactant was instructed to respond to the child's communicative attempts, but not to elicit them in any way. Examples of appropriate, natural responses, included expanding on what the child said or did, commenting about something the child said or did, laughing/clapping in response to a child's actions, and engaging in parallel or interactive play with the child (Wetherby et al., 1988).

The structured observation occurred second and ensured that all participants had the same opportunities to engage in the various gesture types. For this observation, the children were seated in their parent or caregivers lap at a table presented with activities adapted from the Early Social Communication Scales (ESCS; Mundy et al., 1996). The ESCS is a structured observation tool designed to provide measures of nonverbal communication skills of children 8-30 months of age. The activities from the ESCS were used to encourage children to use a broad array of gestures, not elicit them. The investigator or research assistant presenting the participant with the sequence of structured activities from the ESCS was once again instructed not to direct the behavior of the child but respond in a natural manner.

## **Video Coding**

For the unstructured and structured video observations, all videos were edited to stop at 30 second increments and a time stamp was incorporated. This was done to improve reliability and accuracy of the coding. A coding system was created to identify frequency of gesture. All videos were coded by two undergraduate research assistants blind to the purpose of the research study. For each video, the 30-second video segments were watched and the coders tallied the total number of gestures occurring in each segment. When a gesture spanned across two time segments, the gesture was coded in the time segment which it began. In the event that a gesture involved multiple repetitions of the same motor movement (e.g. clapping), this was coded as a single gesture. For the purposes of this study, gestures were defined as intentional motor movements, which are interpretable by others, used for the purpose of communication (Watson et al., 2013). Eye contact, verbalizations, vocalizations, and smiling occurring in isolation were not included in this definition. Gestures occurring in isolation or in combination with eye contact, verbalizations, vocalizations, and smiling were included. To obtain total gesture count, the frequency data for each 30-second segment was tallied and divided by the duration of the video segment resulting in total frequency of gestures used per minute.

## **Reliability**

Twenty percent of the total sample was double coded to determine interrater reliability. Based on Pearson's Product-Moment Correlation, the reliability between the two coders was very strong for the total frequency ( $r = .97$ ) and frequency of behavior regulation ( $r = .96$ ) measures. The reliability between the two coders for the frequency of social interaction gestures ( $r = .75$ ) and the frequency of joint attention gestures ( $r = .74$ ) measures were strong.

## Data Analysis

To investigate the relationships between sensorimotor skills and gesture, and sensorimotor skills and language abilities, four multiple linear regression analyses were utilized. Predictor variables included the following sensorimotor abilities as measured by the MSEL: gross motor, fine motor, and visual reception. Criterion variables included gesture frequency in a structured setting, gesture frequency in an unstructured setting, expressive language, and receptive language. Prior to utilizing the multiple linear regression analyses, the intercorrelation matrix was examined and no issues with multicollinearity between predictors was observed. A post-hoc power analysis was conducted using G\*power (Faul et al., 2009). The power of this study was determined to be 0.88. Results from the ongoing larger study have indicated that participants used significantly higher frequencies of gesture in the structured setting when compared to the unstructured setting. Therefore, these two conditions were analyzed separately when applicable.

## Results

### Sensorimotor and Gesture

In the structured setting, results of a

multiple linear regression analysis indicate that sensorimotor motor abilities had a low to moderate effect size, that is, 17% of the variance in frequency of gesture use ( $R = .42$ ,  $R^2 = 0.17$ ;  $F(3, 50) = 3.40$ ;  $p < .05$ ) is accounted for by sensorimotor abilities. Each sensorimotor skill was then examined for individual contribution to the overall prediction of frequency of gesture use. Gross motor ( $\beta = .11$ ,  $t(52) = .55$ ,  $p \geq .05$ ), visual reception ( $\beta = .33$ ,  $t(52) = 1.82$ ,  $p \geq .05$ ), and fine motor ( $\beta = -.01$ ,  $t(52) = -.03$ ,  $p \geq .05$ ) did not predict gesture abilities independently; however visual reception was nearing significance ( $p = .08$ ). See Table 3.

In the unstructured setting, results of a multiple linear regression analysis indicate that sensorimotor motor abilities had a low to moderate effect size, that is, 15% of the variance in frequency of gesture use ( $R = .39$ ,  $R^2 = 0.15$ ;  $F(3,50) = 3.04$ ;  $p < .05$ ) is accounted for by sensorimotor abilities. Each sensorimotor skill was then examined for individual contribution to the overall prediction of frequency of gesture use. Visual reception was found to be significantly related to frequency of gesture use ( $\beta = .37$ ,  $t(52) = 1.99$ ,  $p < .05$ ); however, gross motor ( $\beta = .03$ ,  $t(52) = .20$ ,  $p > .05$ ) and fine motor ( $\beta = .00$ ,  $t(52) = -.02$ ,  $p > .05$ ) were not. See Table 3.

Table 3  
*Relationships between Gesture and Sensorimotor Skills*

Predictor Variables	$\beta$	$t$	R	$R^2$	F
Structured Setting			.42	.17	3.40*
Gross motor	.11	.55			
Visual reception	.33	1.82			
Fine motor	-.01	-.03			
Unstructured Setting			.39	.15	3.04*
Gross motor	.03	.20			
Visual reception	.37	1.99*			
Fine motor	-.00	-.02			

Note.  $N = 54$ , \* $p < .05$ ; \*\* $p < 0.01$ .

### Sensorimotor and Language

Results of a multiple linear regression analysis indicate that sensorimotor motor abilities were not found to explain a significant proportion of the variance in receptive language abilities ( $R = .36$ ,  $R^2 = 0.11$ ;  $F(3, 50) = 2.12$ ;  $p > .05$ ). See Table 4.

For expressive language, results of a multiple linear regression analysis indicate that sensorimotor motor abilities had a moderate to high effect size, that is, 42% of the variance in expressive language skills ( $R = .69$ ,  $R^2 = 0.42$ ;  $F(3, 50) = 14.91$ ;  $p < .01$ ) is

accounted for by sensorimotor abilities. Each sensorimotor skill was then examined for individual contribution to the overall prediction of expressive language abilities. Gross motor skills were found to be significantly related to expressive language abilities ( $\beta = .41$ ,  $t(52) = 2.58$ ,  $p < .01$ ). Fine motor ( $\beta = .29$ ,  $t(52) = 1.86$ ,  $p > .05$ ) and visual reception abilities ( $\beta = .05$ ,  $t(52) = .36$ ,  $p > .05$ ) were not found to be significantly related to expressive language skills; however, fine motor was nearing significance ( $p = .07$ ). See Table 4.

Table 4  
*Relationships between Language and Sensorimotor Skills*

Predictor Variables	$\beta$	$t$	R	$R^2$	F
Receptive Language			.36	.11	2.12
Gross motor	.03	.13			
Visual reception	.16	.82			
Fine motor	.19	.94			
Expressive Language			.69	.42	14.91**
Gross motor	.41	2.58*			
Visual reception	.05	.36			
Fine motor	.29	1.86			

Note.  $N = 54$ , \* $p < .05$ ; \*\* $p < 0.01$ .

### Discussion

The results of this study support the embodied nature of sensorimotor, language, and gesture skill development. These skills all play an important role in a child's early development and are all interrelated during the infant and toddler years. These findings are of importance because they provide researchers and clinicians with further information about typical development and have the potential to impact future clinical decision making, while supporting the need for multidisciplinary assessment and intervention of children.

This study found that a combination of sensorimotor skills is related to gesture in both structured and unstructured settings thus

providing a response to our first research question addressing the relationship between sensorimotor skills and gesture. Interestingly, when examining each individual sensorimotor skill, visual reception was the only skill related to gesture that reached significance in the unstructured setting ( $p < .05$ ) and neared significance in the structured setting ( $p = .08$ ). These results support embodiment in that visual reception abilities are related to gesture use during early childhood. This is supported by previous work on observations of the development of mimicry (Klerk et al., 2018) and goal-based tasks (Somerville et al., 2005), and may be explained by activation of the mirror neuron system when actions are observed. The finding that fine and gross motor abilities

were not related to gesture was interesting because the use of gesture involves fine and/or gross motor ability. These findings could be explained by the fact that gross and fine motor skills tend to be associated with exploration in early childhood as opposed to communication (Anderson et al., 2013). Gestures are the first instance when a child can communicate and are a prerequisite to language development. Therefore, it may be that gross and fine motor abilities are more highly correlated with exploration actions during this stage of development rather than language. Meanwhile, gestures are communicative in nature which explains the correlation between language and gesture use.

The second research question addressed the relationship between sensorimotor skills and language. This study found no relationship between sensorimotor abilities and receptive language; however, sensorimotor skills explained a significant proportion of the variance in expressive language. When each sensorimotor skill was examined individually, gross motor skills were significantly correlated with expressive language ( $p < 0.01$ ) and fine motor skills were nearing significance ( $p = .07$ ). These findings support other research linking gross motor skills to language abilities (e.g. Iverson & Fagan, 2004; Luike et al., 2019) and fine motor skills to language abilities (Choi et al., 2018, 2019; Luike et al., 2019). Surprisingly, none of the sensorimotor skills were found to be related to receptive language especially in light of the exploratory nature established for gross and fine motor abilities (Anderson et al., 2013); however, this finding is consistent with findings from Franchini et al., 2018 examining developmental profiles of children at risk for developing ASD, which found that motor abilities are more highly related to expressive language than receptive language. This is an area in need of further exploration.

## **Clinical Implications**

Overall, the results of this study support an embodied development perspective with sensorimotor skills relating to gesture and language development. These findings add to the large body of knowledge about typical human development and may translate to assessment and intervention procedures of children at risk of or diagnosed with poor developmental skills. These results support the need to consider the entire developmental profile of a child when determining level of functioning and in planning for assessment and intervention when necessary. Additionally, this paper is of great importance because it supports the need for complementary, interdisciplinary treatment of individuals by healthcare professionals specialized in distinct areas (e.g. speech pathology, physical therapy, and occupational therapy).

## **Limitations**

Though the present study offers important results, it is not without limitations. The first limitation is the sample size. Although adequate for all analyses conducted, given the number of different variables investigated, a larger sample size would have provided results that are more generalizable to the population. The second limitation relates to participants. The participants in this study were homogeneous and represented primarily white, middle class families. Therefore, results of this study are also representative of these demographics and one should use caution when interpreting these results with respect to other races, cultures, and levels of socioeconomic status.

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**Author Note:**

Correspondence for this article should be sent to Jessica Stewart, Department of Communication Sciences and Disorders, University of Texas Rio Grande Valley, 1201 West University Drive, Edinburg, Texas 78504, [jessica.stewart@utrgv.edu](mailto:jessica.stewart@utrgv.edu)