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## Unmasking New Perspectives

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Honors Project: Unmasking New Perspectives

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HNRS 4990

Megan Wilson & Dr. Howard Casey Cromwell

April 17, 2021

## ABSTRACT

This manual and paper explore the question of how educators can heighten their awareness of body language, facial expression, and eye gaze to better understand their student's levels of engagement. Through the examination of pre-existing research in the fields of education and neuroscience this paper identifies physical signals that may indicate a student's cognitive engagement in the classroom. A manual has been created in order to further educate future and current educators on these factors with limitations and a need to further research on the topic.

## INTRODUCTION

Students in the state of Ohio are required to spend a minimum of 910 to 1,001 hours in an educational setting according to Ohio Revised Code section 3313.48. The way in which these hours are spent is dictated by school districts, school curriculum, and most directly, educators. While mandates are put into place and standardized tests often determine how class time should be spent, realistically, teachers plan and execute lessons while engaging students and supporting the needs of their individual students. It is the educator's job to teach the information in a meaningful manner and ensure that their students are actually learning. It is important that teachers are able to adapt their classrooms to best engage their students. For educators, being aware of how cognitively engaged students are in their lessons is critical to growth for those students as well as growth as an educator. This leads to the question that is explored in this manual. **As educators, how can we use our knowledge of facial expressions and body language to heighten our awareness of student engagement?**

This question signifies a new perspective that will combine the neurological aspects of body language and facial expressions to increase the awareness of cognitive engagement in the field of education. This question is pertinent as the education field is rapidly shifting with online

learning and in-person learning looking radically different as students and teachers wear masks due to the Covid-19 global pandemic. This manual will explore the expressive physical signs of cognitive engagement in a traditional classroom setting. While this study has not applied the new wave of online learning, some aspects of the manual may be applicable to students behind a camera as well.

## **GENERAL POINTS**

### **RATIONALE**

The question that has been proposed for this manual is one that focuses on a student-centered approach to the education field. All educators, in theory, aim to foster learning through supporting the individualistic needs of their students. The goal to build rapport through strong teacher-student relationships has proven beneficial to student engagement (Haataja, Salonen, Laine, Toivanen, & Hannula, 2020). While research supports that some factors influence student engagement in the classroom more than others, there is a deficit in the research available for teachers to measure their students' engagement levels. This research is important to improve teacher awareness of student engagement as this directly impacts their students learning process. The combination of neuroscience approaches to observing engagement in the education field is an opportunity for growth in both fields of study when applied to a classroom setting. This manual intends to begin a conversation that should continue to be explored as the education field continues to shift.

### **METHODOLOGY**

This question was sparked while taking HNRS 4980 where a literature review was completed. This research cites peer-reviewed academically acclaimed articles from Ebscohost and google scholar. Key search terms utilized in this conduction of research include facial

expression, body language, classroom, engagement, teacher, classroom-based, peer-reviewed, disabilities, and Autism Spectrum Disorder. The research was expanded based upon citations for highly acclaimed researchers within the field such as Paul Ekman who has presented research before 2010. Among the yields from these numerous searches, 16 articles were selected for contribution to this manual. The findings of these articles are present throughout this manual.

These resources measured engagement utilizing different methodologies which have involved both high and low levels of technological advances. Some methods are more applicable to manners in which a teacher may be able to measure while some are unrealistic to the day-to-day classroom setting.

One method of assessing engagement was completed in a study by D’Mello, Dieterle, and Duckworth in which they were utilizing the Advances, Analytic, and Automated (AAA) measurement approach. This method employs machine sensors that measure neurobiological, bodily, physiological and action-oriented responses that then allowed researchers to identify high-level abstractions which they have labeled as “features.” The researchers then used these results to infer mental states. This is done through video coding as well as identifying self-reported mental states such as mind-wandering (D’Mello, Dieterle, and Duckworth, 2017).

Another method that was utilized in a different study focused on nonverbal eye gaze-tracking (Haataja, Salonen, Laine, Toivanen & Hannula, 2020). Gaze tracking technology was utilized in the classroom setting to measure the natural student-teacher interactions that occur in a classroom setting. This methodology utilized stationary video recordings in the classroom as well as the gaze tracking device around the teacher’s neck or on 3D printer glasses. This technology allowed researchers to measure the naturalistic environment without disrupting the class (Haataja, Salonen, Laine, Toivanen & Hannula, 2020). The methodology in this model has

a higher likelihood of being replicated in a classroom setting as it is non-intrusive and is not as expensive as some of the other technologies implemented in other studies.

In a similar manner, Miller conducted a study that used self-paced reading and eye-tracking to measure engagement with the text. This study looks through the lens of engaging in the material presented in order to cognitively engage in the learning process of a science course. This research measures the amount of time spent on a word through eye-tracking and assumes that “length of reading times or the length of time an eye rests on a word or object can reflect the quantity and quality of cognitive effort a student is using to understand that word or object” (Miller, 2015, p. 35). Therefore, the methodology was able to measure the engagement with the content-based text in the educational setting.

In a study that is focused on students with severe intellectual disabilities by Hollingshead, Williamson, and Carnahan, the study was conducted based on personal experience and reflection in working with these individuals. Because students with disabilities are atypical, their physical appearance when cognitively engaged may not match that of their commensurate neurotypical peers (Hollingshead, Williamson, & Carnahan, 2018). This study emphasizes the importance of an educator being attentive to their students to determine the signs of engagement that may look different depending on each student in the classroom. While this methodology is not well researched, the knowledge of the professionals interviewed adds the depth and gravity of actual experience in the education field.

Chickerur and Joshi utilize 3-D image formatting of facial expressions to allow researchers to examine the facial structures when determining emotions (Chickerur & Joshi, 2015). While facial expressions are digitally created in one study, Chiu uses facial recognition technology and decision tree models to determine FMES (Facial Micro-Expression States).

Another research study by Ouherrou, Elhammoumi, Benmarrakchi, et. al. also used facial expression recognition technology in which considered preprocessing, features extraction, and classification methods.

Whitney, Cheng, Brodersen, and Hong use the methodology which factors in skills and participation and interaction engagement as well as emotional and performance factors to measure micro-engagements. This system is called SCEQ (Whitney, Cheng, Brodersen, & Hong 2019). The focus on measuring engagement through a 13-item Likert scale called RAPS-S is used to measure active engagement in a study titled *Evaluation of Classroom Active Engagement in Elementary Students with Autism Spectrum Disorder* (Sparapani, Morgan, Reinhardt, Schatschneider, & Wetherby, 2015). The numerous research methods found in the studies have been compiled into the creation of this manual. The methodology for this paper is to combine research-based data and information into a comprehensive instructional manual for new and future educators.

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**COGNITIVE ENGAGEMENT MANUAL**

By Christine Jakyma



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**ENGAGEMENT**

The term engagement has not been universally defined among researchers in the education and neuroscience field. The researchers who have authored the articles utilized in this paper each pulled out similar components when providing definitions to the word engagement. Commonalities are rooted in a definition with three dimensions that has been proposed by Fredricks which includes “behavioral, emotional, and cognitive” components to construe student engagement (Olivier, Morin, Langlois, Tardif-Grenier & Archambault, 2020). For the purposes of this manual, the definition of engagement will be limited to cognitive engagement. The factors such as behaviors, emotions, eye contact, body language, and facial expression will be seen as indicators of the complex idea of engagement. When determining what contributes to engagement D’Mello comments, “Person-oriented perspectives focus on the cognitive, affective, and motivational states of the student at the moment of learning and are best captured with fine-grained physiological and behavioral measures (e.g., electrodermal activity, facial expressions, actions)” (D’Mello, Dieterle, & Duckworth, 2017). These “fine-grained” measures are analyzed in the context of a classroom or educational learning setting. The goal of this study is to find actively cognitive engaged behaviors and facial expressions that are applicable amongst a diverse population of students.

**Three significant components to heightening awareness to cognitive engagement:**

- 1. Eye Gaze**
- 2. Facial Expressions & Emotions**
- 3. Body Language**

The definition that has been adopted for this study is authored by D’Mello, S., Dieterle, E., & Duckworth, A. which states, “Cognitive engagement pertains to learners’ investment in the learning task, such as how they allocate effort toward learning, and their understanding and mastery of the material” (D’Mello, Dieterle, & Duckworth, 2017). The key point in this definition that has taken an interest is determining how understanding and mastery of material correlates to the physical signs of engagement that can be observed. It is important to note “that no single component of engagement sufficiently explains the construct” (Hollingshead, A., Williamson, P., & Carnahan, C., 2018). This disclaimer is added as this manual centralizes around one aspect, cognitive engagement, among students in kindergarten through twelfth grade.

**Definition utilized in this manual of cognitive engagement:**

**“Cognitive engagement pertains to learners’ investment in the learning task, such as how they allocate effort toward learning, and their understanding and mastery of the material”**

**~D’Mello, S., Dieterle, E., & Duckworth, A., 2017**

Engagement in the classroom is a prominent component of the learning that takes place in the educational environment. The definition of engagement indicates that students need to be cognitively engaged in order to be involved in learning tasks while understanding the content. There is a potential for students to move through the movements and appear involved in a task while not igniting their brain neurons to engage with actual learning. Disengagement is a threat to the success of students in school and the completion of their educational programs (Olivier,

Morin, Langlois, Tardif-Grenier & Archambault, 2020). In the classroom setting, educators continue to heighten their awareness of the engagement of students. By engaging students, fostering learning, and heightening awareness of levels of student engagement through physical signals teachers will be given the opportunity to best serve their students within the first week of school as they observe their students.

**RELEVANCE IN THE CLASSROOM**

The findings within this manual are intended to be applicable to the classroom setting in allowing teachers to heighten their awareness of their students' cognitive engagement through physical signs such as observing eye movements, body language and facial expressions, as well as visual emotional signs that are present during class time. This manual aims to inform educators about the importance of paying attention to students' nonverbal cues. Looking at how this information can be applied directly to the classroom, some factors within this research are easily applicable to how educators run their class time.

Direct eye-gaze with students can communicate the importance of content to students and help them to stay cognitively engaged in content (Haataja, E., Salonen, V., Laine, A., Toivanen, M., & Hannula, M. S. 2020). Modeling appropriate interactions and collaborations can benefit a student as they learn how to self-regulate their emotions, body language, and facial expressions appropriately in a school setting. An educator can ensure that during small group instruction he or she makes effort to obtain eye contact from students (Haataja, E., Salonen, V., Laine, A., Toivanen, M., & Hannula, M. S., 2020). Maintaining an open body position creates a more inviting and warm environment for students as well. A teacher should look for signs of students who are actively avoiding or trying to make eye contact. By finding out this information, a teacher can shift their teaching strategy to purposefully engage that student in a way that would work best for their needs. Teachers can also teach directly about cognitive, emotional, and behavioral engagement in their classes to help students know the expectations (Hollingshead, Williamson, & Carnahan, 2018).

**Educators consider how they are modeling these key factors**

- **Body language**
- **Facial Expressions**
- **Eye Gaze**

**\*Modeling appropriate indicators of engagement with students can impact students' engagement in the lessons.**

The expectations for students with disabilities can also vary as needs and abilities look unique to each individual which can be met by monitoring the environmental stimuli to increase focus levels in class (Sparapani, Morgan, Reinhardt, Schatschneider & Wetherby, 2015). In addition, all students benefit from a positive classroom environment in which positive emotions are fostered by the teacher (Ouherrou, Elhammoumi, Benmarrakchi & El Kafi, 2019). This importance of maintaining a positive environment is further supported by Chiu, Liaw, Yu, & Chou (2019). These factors are important because disengagement in class is one main factor in dropout rates, failure in school, and externalizing behaviors (Olivier, Morin, Langlois, Tardif-Grenier & Archambault, 2020). Equity in delivery of instruction can also factor into a student's level of engagement on a cognitive level (Marks, 2000). These factors demonstrate the environment, interactions with peers and figures of authority, and overall experience in a classroom contribute directly to the levels of engagement for students. This awareness of how to better engage students and look for signs of engagement can benefit students tremendously.

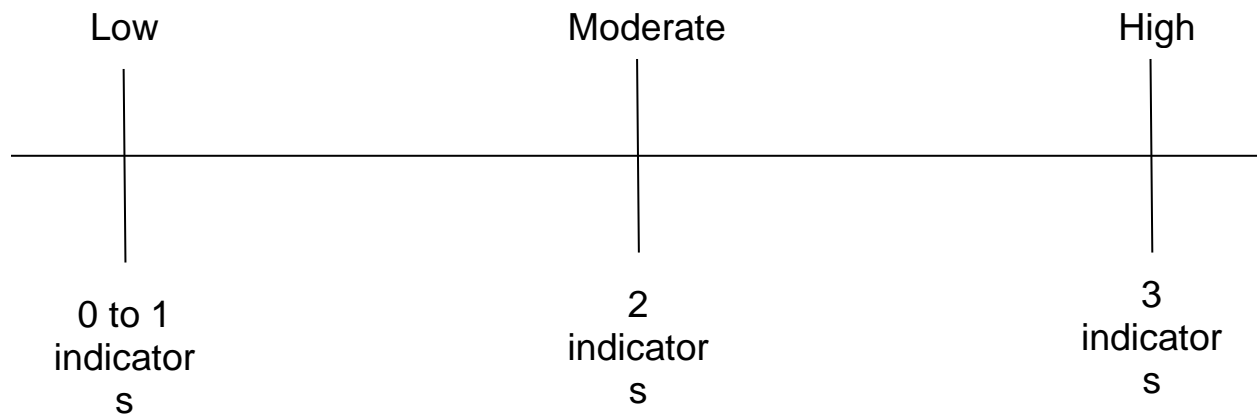
**A note about students with disabilities**

**Students with disabilities will not necessarily show the same physical signs of engagement as their typically developing same aged peers. It is critical to get to know these students and how they demonstrate their cognitive engagement.**

### HOW TO READ CASE STUDY

This case study has been added to the manual in order to show application of concepts further discussed in the following sections. This case study provides only one example of a singular student. It is important to note that the intended use is a learning tool rather than a definitive truth. All students will present their engagement in their own manner among the common signs presented in this module. This case study uses the terms highly, moderately, and low forms of engagement. These terms are defined by the number of positive indicators that are present.

In order for a student to be qualified as being highly cognitively engaged, for the purposes of this case study, all three of the positive indicators must be present. A student who is moderately engaged demonstrates two indicators of cognitive engagement. A student who demonstrates low levels of cognitive engagement will demonstrate one or no indicators of positive body language, facial expressions, and eye gaze.



## Positive and Negative Indicators of Cognitive Engagement

- **Body language**
  - **Positive indicators of engagement: leaning in toward speaker, shoulder/body orientation towards the speaker, sitting up straight with relaxed muscles**
  - **Negative indicators of engagement: slouching posture, body orientation turned away from speaker/work**
- **Facial expression**
  - **Positive indicators of engagement: smiling, raised eyebrows**
  - **Negative indicators of engagement: frowning, furrowing eyebrows\***
- **Eye gaze**
  - **Positive indicators of engagement: making eye contact, eye dwells, eye jumps when reading (see figure 1.2)**
  - **Negative indicators of engagement: avoiding eye contact, gliding eyes when reading**

\*note that this can also be a sign of a student undergoing conceptual change and can be seen as a positive sign of engagement.



**CASE STUDY**

*You are an educator in a third-grade inclusive classroom setting. Your class has a diverse population of neurotypical and neuroatypical students who qualify for special education services. As a new educator, there is immense pressure in ensuring that students are learning during each class period. You teach the core subjects such as math, science, English, and social studies.*

*One of your students, Declan, is having trouble during science class. He is a neurotypical student who does not receive additional services or supports through an IEP or 504 plan. His current grade in science is 75%. Looking at his transcripts from first and second grade you observe that his science grade has been consistently within the 90%-92% range. After chatting with Declan's second grade science teacher, you are able to gather that Declan had shown visible signs of engagement when learning Science in the previous year. The second grade teacher indicates that becoming aware of how Declan is engaging in the class could help you to improve upon supporting his needs by adjusting how you interact with him when in Science class. She points out that eye gaze, facial expression, and body language are all important indicators to watch out for.*

*With this in mind you begin to take notes as you observe Declan during science as well as English class for comparison. In order to collect this data, you will set a timer for every 5 minutes of the class periods. At that point you will make note of exactly what Declan's body language, facial expression, and eye gaze are doing. You will also make note of whether Declan's commensurate peers are doing the same thing that Declan is at the time of observation. Declan has maintained a 96% in English class while maintaining a 75% in science class during*

his third grade school year. Note that science class precedes English class each day. The data collection reads as follows:

<i>Date (time)</i>	<i>Science Class</i>	<i>Is peer doing the same?</i>	<i>Level of engagement</i>	<i>English Class</i>	<i>Is peer doing the same?</i>	<i>Level of engagement</i>
<i>Sept-21</i>						
5	<b>Body language:</b> sitting with a slouched posture <b>Face:</b> neutral <b>Eye:</b> looking at the floor	No	Low	<b>Body language:</b> shoulders facing teacher who is speaking <b>Face:</b> neutral <b>Eye:</b> making eye contact with teacher for 10 seconds	Yes	Moderate
10	<b>Body language:</b> elbows on desk with hands supporting head <b>Face:</b> eyebrows furrowed <b>Eye:</b> eye dwell on whiteboard	Yes	Low	<b>Body language:</b> leaning in toward peer who is speaking to class <b>Face:</b> smiling for duration of conversation <b>Eye:</b> looking at peer who is speaking	Yes	High
15	<b>Body language:</b> Head resting on desk <b>Face:</b> neutral and relaxed muscles in face <b>Eye:</b> closed	No	Low	<b>Body language:</b> sitting up straight <b>Face:</b> smiling for a duration of 5 seconds <b>Eye:</b> dwell on video that is on the screen	Yes	High
20	*Prompted by teacher to sit up and pay attention <b>Body language:</b> Sitting up straight with tense muscles while facing the white board <b>Face:</b> clenched jaw	No	Low	<b>Body language:</b> posture is hunched over desk while reading a book (oriented toward school work while on task)	Yes	High

	<i>Eye: looking at white board</i>			<i>Face: neutral Eye: eyes are jumping as Declan reads his book</i>		
25	<i>Body language: shoulders facing the whiteboard Face: neutral Eye: dwell on the whiteboard</i>	Yes	Moderate	<i>Body language: shoulders facing the whiteboard Face: furrowing eyebrows Eye: dwelling on prompt on the board</i>	No	Moderate
30	<i>Body language: shoulders facing peers while speaking about a prompted question Face: smiling for a duration of 1 second Eye: eye contact is being made with the peer that Declan is speaking to for duration of the conversation</i>	Yes	High	<i>Body language: raising hand before sharing a thought to the class Face: eyebrows raised Eye: eye contact is made with teacher for a duration of 5 seconds</i>	Yes	High
Sept-28						
5	<i>Body language: sitting up straight with relaxed muscles Face: neutral Eye: dwelling on prompt on the board</i>	Yes	Moderate	<i>Body language: sitting up straight while leaning in toward teacher Face: smiling for 4 seconds Eye: eye contact is made with teacher for a duration of 5 seconds</i>	Yes	High
10	<i>Body language: relaxed posture Face: neutral Eye: eye gaze is on the floor</i>	No	Low	<i>Body language: shoulders oriented toward a tradebook which the class is reading Face: neutral Eye: eyes are jumping as he reads the book along with the</i>	Yes	Moderate

				<i>class</i>		
15	<b>Body language:</b> Declan is slouching in his seat with his shoulders against the back of his chair and head tilted toward the floor <b>Face:</b> eyebrows furrowed, frowning <b>Eye:</b> eye gaze is on the floor	No	Low	<b>Body language:</b> shoulders oriented toward a tradebook which the class is reading <b>Face:</b> smiling <b>Eye:</b> eyes are jumping as he reads the book along with the class	Yes	High
20	<b>Body language:</b> Posture remains slouched with shoulders against the back of Declan's chair, head is oriented toward the white board <b>Face:</b> neutral <b>Eye:</b> dwell is occurring on the white board	Yes	Moderate	<b>Body language:</b> hand is raised to answer a question that was asked by the teacher <b>Face:</b> eyebrows are raised <b>Eye:</b> eye contact is made with the teacher for 5 seconds	Yes	High
25	<b>Body language:</b> raising hand to ask a question <b>Face:</b> eyebrows raised <b>Eye:</b> eye contact is made with teacher for 3 seconds	No	High	<b>Body language:</b> Sitting up straight with relaxed muscles. Shoulders are oriented toward white board <b>Face:</b> neutral <b>Eye:</b> dwell on white board	Yes	Moderate
30	<b>Body language:</b> sitting with shoulders oriented toward teacher <b>Face:</b> smiling for a duration of 1 second <b>Eye:</b> eye contact is made with teacher for 1 second	Yes	High	<b>Body language:</b> Standing up for an interactive activity <b>Face:</b> Smiling for a duration of 10 seconds <b>Eye:</b> dwell on the white board where interactive video is being played	Yes	High
Oct-5						
5	<b>Body language:</b>	Yes	High	<b>Body language:</b>	Yes	Moderate

	<i>shoulders oriented toward whiteboard</i> <b>Face:</b> neutral <b>Eye:</b> eye dwell is on the whiteboard			<i>shoulders oriented toward teacher</i> <b>Face:</b> neutral <b>Eye:</b> eyes are dwelling on the white board behind teacher		
10	<b>Body language:</b> <i>hunched over desk while working on a worksheet with a passage</i> <b>Face:</b> eyebrows furrowed <b>Eye:</b> eyes are gliding as Declan reads the worksheet	Yes	Moderate	<b>Body language:</b> <i>Shoulders oriented toward desk and book</i> <b>Face:</b> neutral <b>Eye:</b> eyes are jumping as Declan reads aloud to the class	No	High
15	<b>Body language:</b> head on desk <b>Face:</b> not able to be seen as his head is on the desk <b>Eye:</b> closed	No	Low	<b>Body language:</b> <i>shoulders oriented toward a tradebook which the class is reading</i> <b>Face:</b> eyebrows furrowed <b>Eye:</b> eyes are jumping as he reads the book along with the class	Yes	High
20	<i>*Other students are still working on the worksheet at this time and Declan has left 6 questions unanswered</i> <b>Body language:</b> head on desk <b>Face:</b> not able to be seen as his head is on the desk <b>Eye:</b> closed	No	Low	<b>Body language:</b> <i>sitting up straight in seat while leaning in toward teacher who is speaking</i> <b>Face:</b> smiling for 5 seconds <b>Eye:</b> eye contact is made with the teacher for 3 seconds.	Yes	High
25	<b>Body language:</b> Declan is slouching in his seat with his shoulders oriented towards a peer <b>Face:</b> smiling for duration of 3 seconds	No	Low	<b>Body language:</b> <i>Declan is leaning forward on his desk with his hands supporting his head</i> <b>Face:</b> frowning	No	Low

	<i><b>Eye:</b> eye contact with peer while the teacher is speaking for 3 seconds</i>			<i><b>Eye:</b> dwell on the clock on the wall</i>		
30	<i><b>Body language:</b> Declan is sitting up straight with body oriented toward the clock on the wall <b>Face:</b> eyebrows are raised <b>Eye:</b> dwell on the clock</i>	No	Low	<i><b>Body language:</b> Sitting up straight with shoulders oriented toward teacher <b>Face:</b> neutral <b>Eye:</b> dwell on teacher, no eye contact is made</i>	Yes	Moderate

*You continue to take data each week on the observable actions, body language, and facial expressions evident in your classroom. Within the first three weeks of data collection patterns begin to arise. This may help you begin to understand Declan better.*

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## EYE GAZE

Eye movements can be a strong indication of where an individual's attention is being placed as well as their emotion toward a speaker. Cognitive engagement can be demonstrated through micro-movements in eye gaze. Just as teachers are able to notice a student's engagement in active listening by observing a student's eye gaze, a student can also tell whether a teacher is actively engaged in listening to the student as he or she is speaking. One aspect that is important in keeping students engaged is creating a healthy teacher-student relationship which can be maintained and established through practices such as maintaining eye contact when in conversation. A term that is used to speak about a specific gaze is "dwell." This occurs when the eye gaze is resting on a single target.

**Figure 1.0**



**Figure 1.0 depicts a “dwell” or eyes fixated on a singular target**

By observing the duration of these dwells, an individual can determine whether there is mutual eye contact that is being made in a dyadic (intending to teach) manner (Haataja, E., Salonen, V., Laine, A., Toivanen, M., & Hannula, M. S., 2020). This is significant because students have reported to prefer teachers who maintain eye contact (McIntyre 2016). Teachers who hold longer mutual gaze with students are regarded as having higher communion. Communion is defined by Haataja as “nonverbal immediacy, union, and affiliation that manifest a person’s striving for

belonging to a social entity”(Haataja, E., Salonen, V., Laine, A., Toivanen, M., & Hannula, M. S., 2020). Agency in the same article is defined as “actions of authority, status, dominance, power, and control that convert a person’s urge to be differentiated as an individual" (Haataja, E., Salonen, V., Laine, A., Toivanen, M., & Hannula, M. S., 2020). Therefore, the importance of initiating and maintaining eye contact as an educator needs to be done strategically so as to offer communion rather than agency when trying to build relationships with students. The research article by Haataja indicates that students are engaged with teachers when they are making direct eye contact for longer durations when direct eye contact is reciprocated and maintained by the educator.

**Figure 1.1**



**Figure 1.1 This photo exemplifies positive interactions while maintaining eye contact between two BGSU students.**

### Case Study Application

*Eye contact is a form of eye gaze which is a mutual effort between the two individuals. It is important to note, however, that Declan did have a few eye dwells on the teacher which were*



*not reciprocated by the teacher to achieve eye contact. This is something that teachers should be aware of when presenting to their class.*

*In the case study, Declan makes eye contact in both English and Science class with the educator as well as peers. Looking at the duration of eye contact between the teacher and Declan is a more telling indicator of his cognitive engagement. In addition it is important to identify whether Declan is making eye contact at appropriate times.*

*In science class, Declan first makes eye contact with a peer when prompted to talk through a prompt together. Declan maintains eye contact for the duration of that conversation. This eye contact is both appropriately on task and maintained to show cognitive engagement is occurring. Eye contact is made with the teacher on September 28 on two occasions. One eye contact duration lasted for 3 seconds while the other only lasted for 1 second. These short moments of eye contact can be interpreted as Declan not being cognitively engaged or hoping to not be called on by the instructor.*

*During English class Declan has a pattern of making longer eye contact with the teacher. On multiple occasions, Declan is making appropriate eye contact with the teacher for 5-10 second durations. This prolonged eye contact is an indicator that Declan is cognitively engaged, interested, and may be willing to respond to questions. It is also interesting to note that Declan has eye dwells on the teacher during English class which may show that he was willing to make eye contact although the teacher did not reciprocate.*

Aside from engaging in the classroom with other individuals, eye gaze can be tracked in order to show engagement with class materials. A tool that can be useful is eye-tracking devices which may not be practical within a day-to-day classroom (Miller, 2015). These devices, however, can indicate whether a student is engaging in text based on their eye movements. This implies that slight eye movements can be indicative of mind wandering. D’Mello, Dieterle, and Duckworth cite Smallwood, McSpadden, and Schooler saying, "Mind wandering (or zoning out) occurs when attention drifts away from the learning task to task-unrelated thoughts" (D’Mello, Dieterle, & Duckworth, 2017). Through the eyes, there are four sources for collecting information including the visual channel, face, head tilts, and total body posture and movements (Ekman & Friesen, 2003). As students look at material their eyes should “jump” from one spot to the next as an indicator that the student has engaged or fixated on a particular point before moving on.

Figure 1.2



**Figure 1.2 depicts eye jumping through still photographs of a reader. The eyes shift from the student's left to right as they read. These photos are sequenced numerically. The still shots from a video capture the jumping sensation which can be observed through human observation.**

This is the idea that the student continues to process the word until the eye shifts to the next word (Miller, 2015). These indications of cognitive engagement are minimal, however, they can be seen by the naked eye with practice and close awareness to the student's eyes as they read.

### **Case Study Application**

*Eye jumping and eye gliding can be monitored through careful observation while a student reads.*

*Declan is assigned one worksheet and reading passage in his science class on October 5 at minute 10. The teacher notes that his eyes seem to glide over the passage and worksheet. This may seem like Declan is easily taking in materials as he reads. However, this is not the case. A student will dwell on each word as he or she processes it. When a student's eyes seemingly glide over a passage, he or she may be reading the information while not processing it. This is evident in Declan as he glides over the passage and finishes earlier than other students without completing 6 questions on the worksheet that related to the passage. These factors in relation to viewing eye glides with Declan demonstrate that he had low cognitive engagement in the assignment.*

*In contrast, Declan shows signs of cognitive engagement in English class when reading passages. Declan's eyes are jumping as he reads the book both aloud and along with the class.*

*This jumping motion shows that his eyes are dwelling on words as he processes the information. Declan is later eager as shown through raising his hand to participate in questions regarding the passage as well as reading it to the class. These are all indications of high cognitive engagement.*

While these factors are relevant to many students, there are students who will not fit the mold of maintaining eye contact with other individuals or tracking with their eyes in the manner explained above. Students with disabilities may present in a manner that opposes typical students. A research article by Hollingshead, Williamson, and Carnahan explains that students with disabilities may orient their eye gaze toward the learning materials rather than showing engagement through mutual eye contact with the instructor. In particular, students with Autism Spectrum Disorder tend not to make direct eye contact and in the learning environment can find successful engagement in shifting attention toward the relevant materials (Sparapani, Morgan, Reinhardt, Schatschneider, & Wetherby, 2015). Students may appear to be disengaged based on the behavioral norms in the educational environment while cognitively they are engaged in the learning material (Hollingshead, Williamson, & Carnahan, 2018). Students may have difficulty with engaging peers and materials at the same time which can decrease engagement in the classroom (Sparapani, Morgan, Reinhardt, Schatschneider, & Wetherby, 2015). These discrepancies may be true for neurotypical children as well as each individual is unique in their learning and expressive styles.

## FACIAL EXPRESSION AND EMOTION

Facial expressions are consistent in the research linking facial expression to the emotional and mental state of the individual. A highly regarded and universal form of nonverbal communication is through the use of facial expressions (Chiu, Liaw, Yu & Chou, 2019). Emotions that are universally identified through expressions on the face include happiness, sadness, anger, fear, surprise, and disgust (Chickerur & Joshi, 2015). These facial behaviors of emotion align with a study by Paul Ekman and Wallace Friesen.

**Figure 2.0**



**Figure 2.0 depicts research pictures utilized in a study by Paul Ekman and Wallace Friesen. The photos appear from left to right (top row) as happy, surprised, fear, (second row) anger, disgust, and sadness. Photo retrieved from (Interpret Facial Expressions | Expressions of Emotion | Paul Ekman Group, 2021)**

These emotions can be masked or misinterpreted, but often time for a microsecond, an individual will express their emotions on their face. Facial expressions often do not naturally last more than 5 or 10 seconds unless the emotion is strong enough to produce a sound from the individual. Paul Ekman says that people express their emotions with their most immediate thoughts and emotions through facial expressions (1971).

### **Case Study Application**

*Facial expressions can demonstrate how an individual is feeling and therefore how he or she is engaging with the material.*

*In this case study Declan demonstrates facial expressions through primarily mouth and eyebrow shapes. Smiling is a form of indication that one is cognitively engaged. However, it is important to note the context of the facial expression in order to understand the meaning behind it.*

*In science class, Declan smiles on three occasions for the duration of 1-3 seconds. This positive reaction is made when making eye contact with teachers or peers and can be deemed appropriate to the situation. This shows that in these moments, Declan can be showing cognitive engagement. However, because the durations of these facial expressions are less than 5 seconds, they may also be seen as ingenuine. Facial expressions can indicate cognitive engagement, however, they do not definitely communicate what a person is thinking or how much they are learning. In science class it is much more common to see Declan in a neutral facial expression. Neutral facial expressions do not indicate positive or negative signs of*

*cognitive engagement as need further research to help note the meaning in a relaxed and neutral face. Declan also shows furrowing eyebrows and a frowning mouth shape. These factors are associated with having low cognitive engagement. However, it is important to note that furrowing brows can show that conceptual change is occurring. These changes can be indications of high cognitive engagement in a classroom setting.*

*In the English class, Declan is often seen smiling and with eyebrows lifted. These facial expressions show that there is a positive association with what Declan is learning or the material that he is engaging with. Raised eyebrows can show excitement or eagerness to participate further in the discussion and activities. The duration of these facial expressions ranges between 4-10 seconds. This time allows the observer to understand that these expressions are genuine and that high levels of cognitive engagement are occurring.*

It is common for students to have positive emotions associated with learning. It is important to note, however, that the students may express negative facial expressions when they are going through cognitive change which indicates cognitive engagement (Chiu, Liaw, Yu & Chou, 2019). There is no variance in facial expressions between males and females when going through conceptual change (Ekman & Friesen, 1971). Changes in facial expressions can be voluntary, meaning students would create an expression with intent and awareness. However, there are also research studies which demonstrate that emotional facial expressions can be “an involuntary product of physiological arousal” (Trevisan, Hoskyn, & Birmingham, 2018). This would mean that the student would have an automatically programmed facial response to a stimuli which they can recognize and control after a microsecond of showing the emotion on



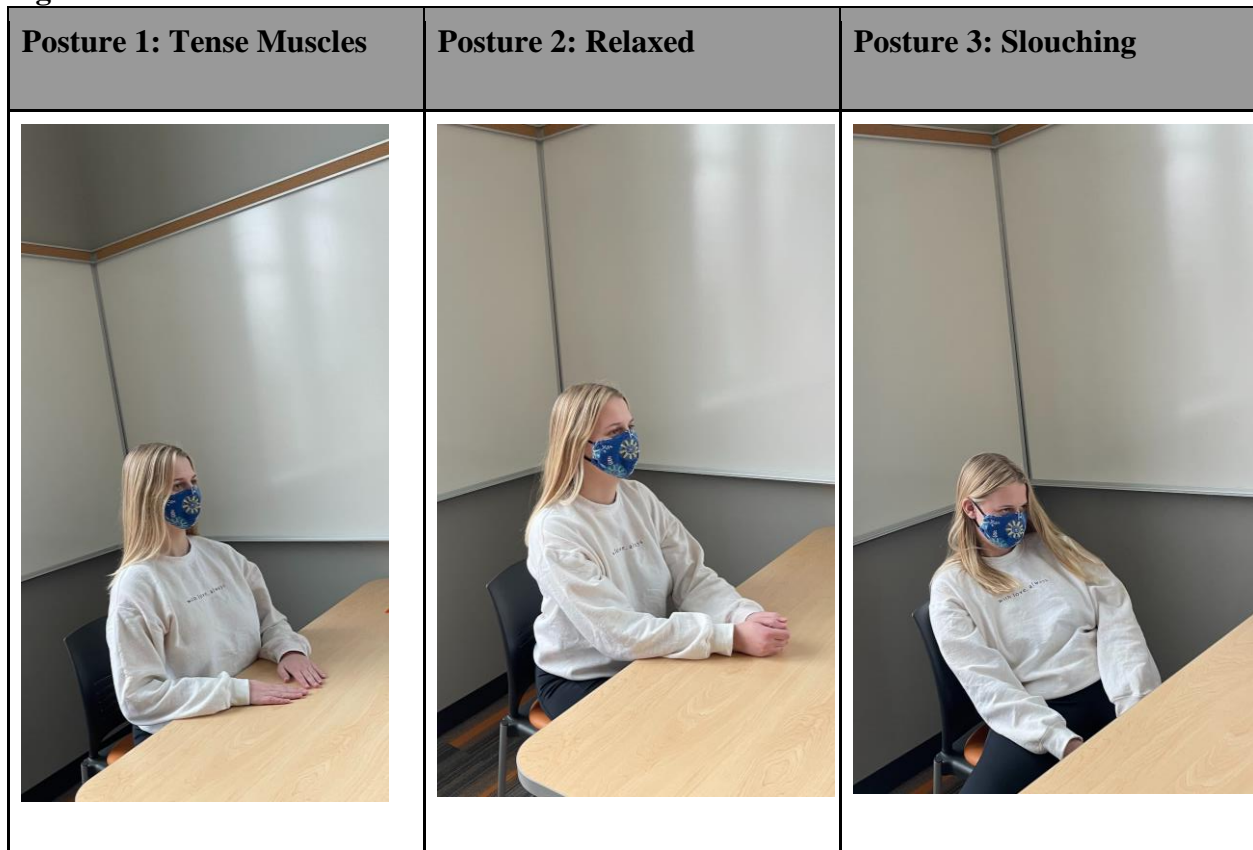
their face (Ekman & Friesen, 2003). Facial expressions are also often automatically mimicked around other individuals when trying to decipher their emotional state such as observing anger and having a mimicked angry expression as found in a study by Price and Hamon-Jones (Price & Hamon-Jones, 2015) . While these facial expressions can be a great indicator of emotional and cognitive engagement, there is always a possibility of misleading others using voluntary facial expressions as well as cultural differences in how an individual expresses themselves in a public setting such as school (Trevisan, Hoskyn, & Birmingham, 2018). The research identified for this manual regarding facial expression supported the findings reflected in this passage with a base in Paul Ekman and Frisen’s claims regarding the six universal emotional facial behaviors.

Diverse students may differ in their interactions and expressions due to upbringing. In cases of cultural differences students may have been raised to respect their others by not making direct eye contact or acknowledging facial expressions of others (Eiman, Friesen, 2003). This does not detract from their knowledge of facial expression significance, but is important to recognize as an instructor. Students who are not neurotypical may not demonstrate the emotions in the same manner as other students in the classroom. Sparapani explains that students who have Autism Spectrum Disorder (ASD) may find it challenging to exhibit the physiological and emotional expressions in a manner that is deemed typical or sufficient for engagement in class (Sparapani, Morgan, Reinhardt, Schatschneider, & Wetherby, 2015). Czapinski, Bryson, and Loveland, et al are cited by Trevisan, Hoskyn, and Birmingham saying students with ASD may also create facial expressions less frequently and in shorter durations, however their emotional levels are consistent with neurotypical individuals (Trevisan, Hoskyn, & Birmingham 2018).

**BODY LANGUAGE**

While the goal of measuring cognitive engagement is not directly observable without self-reporting data or technology, behaviors and body language can act as indications for the mental process. A mind-body link bridges the physical responses which take place in an observable manner when a mental state is occurring (D’Mello, Dieterle, & Duckworth, 2017). Mental states can be demonstrated through slight changes in the body such as tensing or relaxing of the muscles and remaining in a posture showing that they are awake and alert. Physical signs of discomfort may indicate that a student has not cognitively engaged in the material. On the other end of the spectrum, individuals who appear to be too comfortable and drowsy in their seat can also demonstrate that they are not engaging (Hollingshead, Williamson, & Carnahan, 2018).

Larger body movements such as body posture, hand and arm movements, as well as leg and feet movements can be indicative of engagement (Ekman & Friensen 2003). Sparapani focuses on these observable behaviors such as actively raising one’s hand and writing during activities as being an indicator that the student is engaging with the lesson (Sparapani, Morgan, Reinhardt, Schatschneider, & Wetherby, 2015).

**Figure 3.0**

**Figure 3.0 displays postures that may be seen in a classroom. The first photo demonstrates a student who is sitting up straight and tall. This posture along with tense hands may look as if the student is engaged at first glance. However, this posture may also indicate that the student is uncomfortable in your classroom. This student is tensing her muscles. The second photo demonstrates the posture of a student who is engaged. She is leaning in toward the front of the classroom with relaxed hands. The third photo is a student who is slouching and disengaged. Leaning back in her chair with her shoulders oriented away from the speaker and chin down can indicate that a student is not cognitively engaged.**

### *Case Study Application*

*Declan demonstrates all three of the postures shown in figure 3.0 throughout the observation period.*

*Looking at the patterns among science class, Declan appears to alternate between tensing his muscles when asked to sit up and slouching with his shoulders against the back of the chair.*

*These two postures are seen as negative indicators of cognitive engagement meaning that while he is sitting in these two positions he is likely not engaging in the class. In addition to these two postures Declan also lays his head on the desk and closes his eyes. These are important distinctions that indicate he is not visually or physically engaging which makes the likelihood of cognitive engagement low.*

*In contrast, Declan mainly demonstrated the relaxed and engaged posture seen in figure 3.0 while in English class. This relaxed posture indicates that Declan feels comfortable in the classroom. Leaning in toward the educator or individual that is speaking is also a great sign of cognitively engaging. Orientation of Declan's shoulders can help to indicate what he is engaged with while being observed such as the white board with a prompt, worksheets, books, peers, and the teacher. When body language is matched with that of his peers with positive indicators of cognitive engagement we are able to see that he is on task. These signs are all indicative of high cognitive engagement.*

*Furthermore, Declan demonstrates high levels of cognitive engagement when he raises his hand to ask questions and volunteer. Utilizing extremities indicates that there is a willingness to be involved in the learning process.*

Darwin says that the full body is expressive of emotion and thus engagement. Other research suggests that students who orient their bodies toward materials without making eye contact provide evidence for engagement. A positive example that teachers should implement includes creating an open body orientation to the class to encourage cognitive engagement in

lessons (Haataja, Salonen, Laine, Toivaen, & Hannula, 2020). Figure 3.1 demonstrates how a teacher may use body language to create a positive and engaging environment as well as a sample of teaching orientations that will not foster engagement.

**Figure 3.1**



**Figure 3.1 depicts open posture while teaching. Open orientation includes turning shoulders and body toward students while teaching. The student is demonstrating body language indicating that she is engaged in the lesson and willing to participate.**

**Figure 3.2**



**Figure 3.2 depicts closed posture while teaching. The teacher orients her body away from the class without making eye contact. This orientation does not engage students and should be avoided when instructing students. The student is facing the board without showing any other indications of engagement.**

Students who have severe Intellectual Disabilities may appear to be disengaged due to their body language, behavior, or posture. This can be deceiving as individuals with disabilities may present their engagement in the classroom without physically showing through facial expression or body orientation that they are cognitively engaged (Hollingshead, Williamson, & Carnahan, 2018). It is important to understand that all students vary in their expression of cognitive engagement and learn in unique ways. Body orientation and posture can help to heighten awareness of cognitive engagement once an individual's manner of learning is understood by the teacher.

## CONCLUSION

As educators, we can use knowledge of facial expression and body language to heighten awareness of cognitive engagement that is occurring in our classrooms. Research supports that signs of engagement are evident through mental processes shown in eye gaze and eye contact. Through close observation, students' eye movements demonstrate how quickly a student is processing written information. When a student's eyes glide they are less likely to be processing information than a student whose eyes jump as they read a sentence. In addition, mutual eye contact is a strong indicator of positive and active engagement and interest in the educational setting. The focus on eye dwells can also be a sign that a student is cognitively engaging with material that is presented on the board or in text. These features can be quickly detected by an educator that is looking for signals to show that their student is cognitively engaged and are the most reliable of the three indicators mentioned in this paper and manual.

Facial expressions and emotions are another way to observe students' cognitive engagement. Utilizing the six universally recognized facial expressions, teachers can build awareness of how their student is feeling in the classroom and during a lesson. Positive facial expressions indicate that the student may be cognitively engaged and interested in the lesson. These expressions can be most easily detected through observing eyebrow shape such as raised eyebrows and mouth shape through smiling. Negative expressions may indicate that a student is disengaged such as frowning. Furrowing one's brows can be interpreted as watching a student who is going through a conceptual change, therefore growing, but may also be seen as a sign of low cognitive engagement. Educators can analyze how each student uses facial expressions within the early portion of a school year so that they can best support their student when they notice the concept is frustrating rather than improving learning. A teacher should also be

cognizant about how they present themselves to the classroom as their expression should remain positive. Students may mimic this facial expression and set a positive, inviting, and engaging tone for the class. Facial expressions are not the most reliable method of indicating cognitive engagement in students.

Body language is not as telling when it comes to heightening awareness of student engagement for individuals with disabilities. Participation movements, such as raising one's hand or orienting one's shoulders to the speaker and content, can demonstrate a student's engagement in the lesson. There are many alternative factors to considering body language as a reliable form of engagement. It can be easy for students who are engaged cognitively to orient their body toward their work rather than the educator as he or she speaks. This may be how the student best focuses and engages. Students may also choose not to raise their hands while being fully cognitively engaged. Contrastingly, students who are sitting up straight and tense may be uncomfortable in the classroom. While their posture may show them to be a student who is ready to learn, their discomfort may cause them to not engage in the course. This measure can help to heighten awareness of engagement, but is not as strong of an indicator as viewing a student's eye gaze.

Further research areas that should be explored include research into engagement in online courses and manners in which educators can increase their awareness in an e-learning setting. In addition, a largely unexplored area relating this cognitive engagement is in students who have disabilities. Many articles suggested that on-task behaviors show that students are engaged. Students with disabilities often need to be supported differently when learning. Becoming aware of their levels of engagement through more surface level behavioral observations can and should



be discovered. As technology progresses, finding other manners which are practically applied to a classroom setting will be beneficial to educators and students alike.

## **LIMITATIONS**

This honors project has been completed as a research literacy review while combining many different methodologies of research. One limitation of this paper is that not all researchers utilized measured engagement in the same manner with the same definition. Multiple definitions contributed to the research that was utilized while narrowing one specific definition to be applied to this manual. In addition, the research that was selected for this paper are not the only aspects that contribute to cognitive engagement in a classroom. The physical signs of body language, facial expression, and eye gaze has limited this manual to only include these factors without consideration for other ideologies behind determining a process which happens within an individual's mind. Individuals who choose to use this manual should be aware of these factors and further research into other methodologies of heightening awareness of student engagement in addition to utilizing this manual.

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