

prenda

RESEARCH ALIGNMENT

The Science Behind Microschools

Executive Summary

Data clearly indicate that “school” as traditionally formatted isn’t working well for many students. For example, motivation and engagement rates are reportedly falling and low national academic proficiency persists. In an effort to remedy these negative trends and increase the percentage of students who are thriving personally and academically, we focus our pedagogy and practice on 3 key pillars.

Pillar 1: Connection

We cultivate connection by providing students with warm, accepting, and supportive relationships regardless of academic performance or behavior. This creates an environment that fosters superlative brain development and mental wellness.

Pillar 2: Personalization

We prioritize personalization by ensuring that each student is encouraged to work at a level and pace that allows for mastery and by incorporating personal interests into learning. This means that each student is treated as an individual and allowed the flexibility they need to succeed.

Pillar 3: Ownership

We honor student ownership of the learning process by providing developmentally appropriate, autonomy-supportive environments. This leads students to take responsibility for their learning and fosters self-efficacy.

Pillar 1: Connection

We cultivate connection by providing students with warm, accepting, and supportive relationships, regardless of academic performance or behavior.

Rationale

The region of the brain involved in goal-directed behavior, sustained attention, memory, inhibition, information processing, learning, problem-solving, and decision-making is called the Prefrontal Cortex (PFC). This area of the brain goes offline when the body's stress response system is triggered. One of the main things that activates the stress response system is when a child feels like their relationship with one of their primary caregivers (parent/teacher) is at risk. This means that if we want our students to learn, stay focused, and behave well, we must offer them warmth, acceptance, and support regardless of their academic or behavioral struggles.

Research

The PFC plays a vital role in executive functioning, emotional regulation, attention, learning, and behavioral inhibition.

Neuropsychology of Prefrontal Cortex

Siddiqui SV, Chatterjee U, Kumar D, Siddiqui A, Goyal N. Neuropsychology of prefrontal cortex. *Indian J Psychiatry*. 2008 Jul;50(3):202-8. doi: 10.4103/0019-5545.43634. PMID: 19742233; PMCID: PMC2738354.

Prefrontal Contribution to Decision-Making

Funahashi, S. (2017). Prefrontal Contribution to Decision-Making under Free-Choice Conditions. *Frontiers in Neuroscience*, 11. <https://doi.org/10.3389/fnins.2017.00431>

Prefrontal Cortex and Executive Function in Young Children

Moriguchi, Y., & Hiraki, K. (2013). Prefrontal cortex and executive function in young children: A review of NIRS studies. *Frontiers in Human Neuroscience*, 7. <https://doi.org/10.3389/fnhum.2013.00867>

The PFC goes offline when the sympathetic nervous system activates the stress response, making it difficult for students to learn, focus, manage emotions, and inhibit behavior.

Neurobiology of executive functions: catecholamine influences on prefrontal cortical functions

Arnsten AF, Li BM. Neurobiology of executive functions: catecholamine influences on prefrontal cortical functions. *Biol Psychiatry*. 2005 Jun 1;57(11):1377-84. doi: 10.1016/j.biopsych.2004.08.019. PMID: 15950011.

Limbic Regulation of Hypothalamo-Pituitary-Adrenocortical Function During Acute and Chronic Stress

Jankord, R., & Herman, J. P. (2008). Limbic Regulation of Hypothalamo-Pituitary-Adrenocortical Function During Acute and Chronic Stress. *Annals of the New York Academy of Sciences*, 1148, 64. <https://doi.org/10.1196/annals.1410.012>

Acute stressors and cortisol responses: a theoretical integration and synthesis of laboratory research

Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: a theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, 130(3), 355–391. <https://doi.org/10.1037/0033-2909.130.3.355>

Prolonged stress response causes long-term cognitive and social issues including decreased working memory and self-regulation.

Childhood poverty, chronic stress, and adult working memory

Evans, G. W., & Schamberg, M. A. (2009). Childhood poverty, chronic stress, and adult working memory. *Proceedings of the National Academy of Sciences of the United States of America*, 106(16), 6545–6549. <https://doi.org/10.1073/pnas.0811910106>

Temperament, social competence, and adrenocortical activity in preschoolers

Gunnar MR, Tout K, de Haan M, Pierce S, Stansbury K. Temperament, social competence, and adrenocortical activity in preschoolers. *Dev Psychobiol*. 1997 Jul;31(1):65–85. doi: 10.1002/(sici)1098-2302(199707)31:1<65::aid-dev6>3.0.co;2-s. PMID: 9222117.

Stress and the Development of Self-Regulation in Context

Blair, C. (2010). Stress and the Development of Self-Regulation in Context. *Child development perspectives*, 4(3), 181. <https://doi.org/10.1111/j.1750-8606.2010.00145.x>

The stress response and its subsequent negative effects can be mitigated by a consistent, supportive adult-child relationship. Relationships and attachment predict social and academic outcomes.

Protecting Adolescents From Harm. Findings from the National Longitudinal Study on Adolescent Health

Resnick, M. D., Bearman, P. S., Blum, R. W., Bauman, K. E., Harris, K. M., Jones, J., Tabor, J., Beuhring, T., Sieving, R. E., Shew, M., Ireland, M., Bearinger, L. H., & Udry, J. R. (1997). Protecting adolescents from harm. Findings from the National Longitudinal Study on Adolescent Health. *JAMA*, 278(10), 823–832. <https://doi.org/10.1001/jama.278.10.823>

Social Regulation of the Cortisol Levels in Early Human Development

Gunnar, M. R., & Donzella, B. (2002). Social regulation of the cortisol levels in early human development. *Psychoneuroendocrinology*, 27(1-2), 199–220. [https://doi.org/10.1016/S0306-4530\(01\)00045-2](https://doi.org/10.1016/S0306-4530(01)00045-2)

Fostering Secure Attachment in Infants in Maltreating Families Through Preventive Interventions

Cicchetti, D., Rogosch, F.A., & Toth, S.L. (2006). Fostering secure attachment in infants in maltreating families through preventive interventions. *Development and Psychopathology*, 18(03). <https://doi.org/10.1017/s0954579406060329>

Attachment and Biobehavioral Catch-up: Addressing the Needs of Infants and Toddlers Exposed to Inadequate or Problematic Caregiving

Dozier, M., & Bernard, K. (2017). Attachment and Biobehavioral Catch-up: Addressing the Needs of Infants and Toddlers Exposed to Inadequate or Problematic Caregiving. *Current opinion in psychology*, 15, 111. <https://doi.org/10.1016/j.copsyc.2017.03.003>

Family Resources and Parenting Quality: Links to children's cognitive development across the first 3 years

Lugo-Gil, J., & Tamis-LeMonda, C. S. (2008). Family resources and parenting quality: links to children's cognitive development across the first 3 years. *Child development*, 79(4), 1065–1085. <https://doi.org/10.1111/j.1467-8624.2008.01176.x>

Maternal Responsiveness and Children's Achievement of Language Milestones

Tamis-LeMonda, C. S., Bornstein, M. H., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child development*, 72(3), 748–767. <https://doi.org/10.1111/1467-8624.00313>

Attachment and School Completion: Understanding Young People Who Have Dropped Out of High School and Important Factors in Their Re-Enrollment

Ramsdal, G. H., & Wynn, R. (2022). Attachment and School Completion: Understanding Young People Who Have Dropped Out of High School and Important Factors in Their Re-Enrollment. *International Journal of Environmental Research and Public Health*, 19(7). <https://doi.org/10.3390/ijerph19073938>

Learn More

Why Adults Need to Matter More Than Peers by Gordon Neufeld

Hold On to Your Kids by Gordon Neufeld and Gabor Mate

Reclaiming Our Students by Hannah Beach & Tamara Strijack

The Development of the Person by L. Alan Stroufe, et al

How Children Succeed by Paul Tough

Stress 101: Don't Go NUTS with Dr. Sonia Lupien




Pillar 2: Personalization

We prioritize personalization by ensuring that each student is treated as an individual and allowed the flexibility required to learn in ways that meet their unique needs and interests.

Rationale

With the advent of ubiquitous access to information and technological advances in our modern age, education no longer needs to be limited by the one-size-fits-all system established in the 19th century. Individualized learning systems have been shown to be as effective as (or better than) whole-group instruction. By adopting a personalized approach to pacing, learning method, and content choices students will be better able to reach their full potential as they increase in curiosity, creativity, and collaborative problem-solving.

Research



Mastery-based learning allows students to develop skills and knowledge at their own pace, ensuring that academic foundations are strong before moving on.

The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring

Bloom, B. S. (1984). The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring. *Educational Researcher*, 13, 4-16. <http://dx.doi.org/10.3102/0013189X013006004>

Research on Mastery-Based Group Learning Programs: A Meta-Analysis


Guskey, T. R., & Pigott, T. D. (1988). Research on group-based mastery learning programs: A meta-analysis. *The Journal of Educational Research*, 81(4), 197-216. <https://doi.org/10.1080/00220671.1988.10885824>

Effectiveness of Mastery Learning Programs: A Meta-Analysis.

Kulik, C. L. C., Kulik, J. A., & Bangert-Drowns, R. L. (1990, June). Effectiveness of Mastery Learning Programs: A Meta-Analysis. *Review of Educational Research*, 60(2), 265-299. <https://doi.org/10.3102/00346543060002265>

Transforming Learning through Competency-Based Education


Patrick, S. (2021). Transforming Learning through Competency-Based Education. *State Education Standard*, 21(2), 23-29. <https://eric.ed.gov/?id=EJ1315095>



Using instructional methods that meet each student at their current level of understanding while also supporting students in their personalized pace strengthens feelings of competence and improves outcomes.

Continued Progress: Promising Evidence on Personalized Learning

Pane, John F., et al. (2015). Continued Progress: Promising Evidence on Personalized Learning. ERIC, RAND Corporation, 1 Nov. 2015, eric.ed.gov/?id=ED571009.



The Rise of K-12 Blended Learning

Horn, M., Staker, H., Hassel, B., & Ableidinger, J. (2011). The Rise of K-12 Blended Learning. <https://aurora-institute.org/wp-content/uploads/The-Rise-of-K-12-Blended-Learning.pdf>

The Results of Implementing Zone of Proximal Development on Learning Outcomes

Baker, Ryan & Ma, Wei & Zhao, Yuxin & Wang, Shengni & Ma, Zhenjun. (2020). The Results of Implementing Zone of Proximal Development on Learning Outcomes.

How to Personalize Learning in K-12 Schools: Five Essential Design Features

Lee, D. (2014). How to Personalize Learning in K-12 Schools: Five Essential Design Features. *Educational Technology*, 54(3), 12-17. <http://www.jstor.org/stable/44430266>



Both mastery and personalized pacing can be implemented effectively using adaptive digital learning tools as a primary means of instruction.

Intelligent Tutoring Systems and Learning Outcomes: A Meta-Analysis

Ma, W., Adesope, O., Nesbit, J., & Liu, Q. (2014). Intelligent Tutoring Systems and Learning Outcomes: A Meta-Analysis. <https://www.apa.org/pubs/journals/features/edu-a0037123.pdf>

When adaptive learning is effective learning: comparison of an adaptive learning system to teacher-led instruction


Shuai Wang, Claire Christensen, Wei Cui, Richard Tong, Louise Yarnall, Linda Shear & Mingyu Feng (2023) When adaptive learning is effective learning: comparison of an adaptive learning system to teacher-led instruction, *Interactive Learning Environments*, 31:2, 793-803, DOI: 10.1080/10494820.2020.1808794

The Relative Effectiveness of Human Tutoring, Intelligent Tutoring Systems, and Other Tutoring Systems

VanLEHN, K. (2011). The Relative Effectiveness of Human Tutoring, Intelligent Tutoring Systems, and Other Tutoring Systems. *Educational Psychologist*, 46(4), 197-221. <https://doi.org/10.1080/00461520.2011.611369>

A Comprehensive Historical Survey with Recent Developments

Alkhatlan, A., & Kalita, J. (2019). Intelligent Tutoring Systems: A Comprehensive Historical Survey with Recent Developments. *International Journal of Computer Applications*, 181(43), 1-20. <https://doi.org/10.5120/ijca2019918451>



Guided inquiry and project or problem-based learning, when paired with direct instruction, increases engagement and curiosity while maintaining or improving outcomes.

Traditional and Inquiry-Based Learning Pedagogy: A Systematic Critical Review


Resnick, M. D., Bearman, P. S., Blum, R. W., Bauman, K. E., Harris, K. M., Jones, J., Tabor, J., Beuhring, T., Sieving, R. E., Shew, M., Ireland, M., Bearinger, L. H., & Udry, J. R. (1997). Protecting adolescents from harm. Findings from the National Longitudinal Study on Adolescent Health. *JAMA*, 278(10), 823-832. <https://doi.org/10.1001/jama.278.10.823>

Let's Talk Evidence - The case for combining inquiry-based and direct instruction

Gunnar, M. R., & Donzella, B. (2002). Social regulation of the cortisol levels in early human development. *Psychoneuroendocrinology*, 27(1-2), 199-220. [https://doi.org/10.1016/S0306-4530\(01\)00045-2](https://doi.org/10.1016/S0306-4530(01)00045-2)

Problem-Based Learning in K-12 Education: Is it Effective and How Does it Achieve its Effects?

Wirkala, C., & Kuhn, D. (2011). Problem-Based Learning in K-12 Education: Is it Effective and How Does it Achieve its Effects? *American Educational Research Journal*, 48(5), 1157-1186. <https://doi.org/10.3102/0002831211419491>



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Learn More

Let's Teach for Mastery by Sal Khan

What is Mastery Learning with Khan Academy

The Difference Between Traditional Education and Personalized,

Competency-Based Education with Knowledge Works

Implementing Mastery Learning by Thomas Guskey

Mastery Learning with Thomas Guskey with Corwin Leaders Podcast

Pillar 3: Ownership

We honor student ownership of the learning process by providing developmentally appropriate autonomy-supportive environments.

Rationale

The world we have built for our children and students consistently suggests to them that they cannot be trusted, that they are incapable, and that the only way to succeed is to jump through the hoops we've laid out for them. Unfortunately, feeling untrusted, incapable, and like you have little control over life negatively impacts academic achievement, motivation, mental well-being, and engagement. By creating a new educational system and culture where adults allow young people to make meaningful decisions, trust them to lead, and provide ample opportunity for them to learn from their mistakes we hope to increase engagement, motivation, achievement, and effective self-governance.

Research

Providing students with increased autonomy over their educational experience drives academic achievement, motivation, and mental well-being.

Student Autonomy and Empowerment

Adolescent and School Health | CDC. (2021, August 18). [www.cdc.gov](https://www.cdc.gov/healthyyouth/classroom-management/student_autonomy.htm).
https://www.cdc.gov/healthyyouth/classroom-management/student_autonomy.htm

Parent Autonomy Support, Academic Achievement, and Psychosocial Functioning: a Meta-analysis

Vasquez, A. C., Patall, E. A., Fong, C. J., Corrigan, A. S., & Pine, L. (2015). Parent Autonomy Support, Academic Achievement, and Psychosocial Functioning: a Meta-analysis of Research. *Educational Psychology Review*, 28(3), 605–644. <https://doi.org/10.1007/s10648-015-9329-z>

Effects of Parental Autonomy Support and Teacher Support on Middle School Students' Homework Effort

Feng, X., Xie, K., Gong, S., Gao, L., & Cao, Y. (2019). Effects of Parental Autonomy Support and Teacher Support on Middle School Students' Homework Effort: Homework Autonomous Motivation as Mediator. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.00612>

Providing students with experiences that support their sense of personal control and competence fosters grit and self-efficacy.

Learning From Human Tutoring

Chi, Michelene & Siler, Stephanie & Jeong, Heisawn & Yamauchi, Takashi & Hausmann, Robert. (2001). Learning from human tutoring. *Cognitive Science*. 25. 471-533. 10.1016/S0364-0213(01)00044-1.

Learned Helplessness: Theory and Evidence

Maier, S., & Seligman, M. (1976). Learned Helplessness: Theory and Evidence. *Journal Of Experimental Psychology: General*, 105(1), 3–46. <https://ppc.sas.upenn.edu/sites/default/files/lhtheoryevidence.pdf>

The Effects of Locus of Control on Learning Performance

Özen Kutanis, Rana & Mesci, Muammer. (2011). The Effects of Locus of Control on Learning Performance: A Case of an Academic Organization. *Journal of Economic and Social Studies*. 1. 10.14706/JECOSS11125.

Locus of Control and Academic Achievement in High School Students

Shepherd, S., Owen, D., Fitch, T. J., & Marshall, J. L. (2006). Locus of Control and Academic Achievement in High School Students. *Psychological Reports*, 98(2), 318–322. <https://doi.org/10.2466/pr0.98.2.318-322>

Intrinsic Motivation and the Process of Learning: Beneficial Effects of Contextualization, Personalization, and Choice.

Cordova, Diana & Lepper, Mark. (1996). Intrinsic Motivation and the Process of Learning: Beneficial Effects of Contextualization, Personalization, and Choice. *Journal of Educational Psychology*. 88. 715-730. [10.1037/0022-0663.88.4.715](https://doi.org/10.1037/0022-0663.88.4.715).

Children's Preference for Challenge: The role of perceived competence and control.

Boggiano, A. K., Main, D. S., & Katz, P. A. (1988). *Children's preference for challenge: The role of perceived competence and control*. *Journal of Personality and Social Psychology*, 54(134-41). <https://doi.org/10.1037//0022-3514.54.1.134>

School and family effects on the ontogeny of children's interests, self-perceptions, and activity choices.

Eccles, J. S. (1992). School and family effects on the ontogeny of children's interests, self-perceptions, and activity choices. *Nebraska Symposium on Motivation*. *Nebraska Symposium on Motivation*, 40(40), 145–208. <https://pubmed.ncbi.nlm.nih.gov/1340520/>



Respecting student ownership by decreasing adult use of extrinsic motivators fosters a greater sense of personal purpose, long-term enjoyment of learning, and increased motivation.

Intrinsic and Extrinsic Motivational Orientations in the Classroom

Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and Extrinsic Motivational Orientations in the Classroom: Age Differences and Academic Correlates. *Journal of Educational Psychology*, 97(2), 184–196. <https://doi.org/10.1037/0022-0663.97.2.184>

A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, 125(6), 627–668.

When do extrinsic rewards undermine intrinsic motivation? A meta-analysis

Lehtivuori, A. (2023). When do extrinsic rewards undermine intrinsic motivation? A meta-analysis

Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning

Malone, T.W. and Lepper, M.R. (1987) Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning. In: Snow, R.E. and Farr, M.J., Eds., *Aptitude, Learning and Instruction III: Conative and Affective Process Analyses*, Erlbaum, Hillsdale.

Learn More

Promoting Motivation, Health, and Excellence by Edward Deci

Creating Autonomy-Supportive Learning Environments by Jon Stolk

The Self-Driven Child by Ned Johnson and William Stixrud

Raising Human Beings by Ross Green

Punished by Rewards by Alphonse Kohn

Self-Determination Theory by Ryan and Deci