

Literature Review of the Influence of AI-based Personality Traits on Academic Achievement, Problem-solving and Ethical Consideration Act as Mediators

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Abstract – This narrative review uses a systematic synthesis of current literature to identify the complex relationships between the personality of the individual, academic achievement, ethical dimensions, problem-solving, and the role of AI within the systems of education. The core of this research is to find how conscientiousness, extraversion, and openness affect individual's academic accomplishments, ethical levels, and problem-solving skills and the degree of ethical concern when applying AI technology in classrooms. The results show that conscientiousness, especially its aspect of achievement striving and self-discipline, is the strongest and most consistent predictor of academic success, while extraversion tends to negatively correlate with university-level success due to social and sensation-seeking engagement by extraverted individuals. In relation to problem solving, openness and conscientiousness are the significant predictors of problem-solving skills. In the ethical dimension of educational integrity, conscientiousness and openness sustain individual ethical behaviour by a strong sense of self-control and individual ethical behaviour. Furthermore, a positive bias of extraversion also results in socially ethical behaviour. Effective integration of AI while sustaining the overlapping ethical dimension encourages collaborative work among computer scientists, ethicists, and policy makers. It is clearly important to have ethically grounded AI learning systems.

Keywords – narrative review, personality traits, academic achievement, problem-solving, ethical behaviours

I. INTRODUCTION

Higher education is always changing, primarily due to the rapid integration of Artificial Intelligence (AI) in teaching and learning (Jang, H., 2024). Undergrad performance at universities worldwide, particularly in China is impacted by multiple elements ranging from personal characteristics to advanced technologies like AI. Great research on psychology has identified important aspects of personality (openness, conscientiousness, agreeableness, extroversion and neuroticism), and how each affects learning and performance for Chinese university students (Shangyu Li, 2024). Evidence suggests that personality functions as a robust forecaster of academic success, extending well beyond the classroom and into wider technologically advanced societies. We can consider the foundations of personal characteristics including openness to experience, hard work, and warmth, as well as sociability and emotional stability, as important for students' educational achievement, the ability to work with others, and the potential to improve their financial and overall well-being in an educational environment integrated with AI

technology (Swart, E, 2021). The focus of this study was on students' attitudes toward AI-made learning recommendations and their interactions with an AI-based learning dashboard. This study highlights the importance of careful and strategic design of AI in educational contexts to enhance learning (AA). The presented research highlights the positive potential of educational technology design. (Zheng, Y, 2024)

Research indicates the importance of enhancing the Big Five personality traits of counselors in order to promote positive academic and general well-being of university students. (Shangyu Li, 2024). Such traits have significant impact on how students approach and engage with coursework, newly emerging technologies, and academic challenges. For example, responsibility and self-control have traits of Conscientiousness which have been associated with good academic performance (Ranjeet et al., 2020) and an attitude of acceptance towards the use of educational technologies. (Aristovnik, et al., 2020). Conscientiousness is among the strongest predictors of academic performance in AI-integrated educational technologies (Ranjeet et al., 2020) and has been well established in the literature.

When it comes to harnessing the full benefits of AI in education, excellent problem-solving skills are crucial. Findings from this study suggest that the deployment of AI tools, along with the production of a work that is subject to strict quality assurance, encompasses cognitive mechanisms such as critical thinking, and the learning and use of (mathematical) knowledge. As such, even though problem-solving is not in the foreground in this study, it is included in the processes. It is therefore reasonable to argue that 'effective problem-solving' as an outcome of these processes, is closely related to academic performance. (Ma, 2021). The challenges presented by AI (e.g., the ethical issues of data protection, fairness in AI, the ethics of AI in the automated decision-making processes in the education system) all have an impact on the educational landscape. AI-based systems often require the collection and processing of a vast amount of personal data, including information on the student's academic history, preferences, and social interactions. The wrongful use and the unauthorized release of such data can endanger the privacy and safety of students. In addition, within the field of academic evaluation, algorithms can produce biased evaluations to particular student groups. These ethical issues raise the need for a careful balance and regulation in the use of AI in education in order to realize the potential of the technology without compromising ethical principles. (Zheng, 2024)

II. PROBLEM STATEMENT

There are many discrepancies in Chinese student academic performance, and those discrepancies stem from

various elements, including the integration of technology and a student's characteristics. As universities begin to adopt technology (Zheng, 2024), understanding the variables behind positive performance becomes exceedingly pertinent. In the Chinese system of higher education, the performance gaps are attributed to a range of elements, including cognitive ability and students' ability to use and adapt to different forms of learning technologies (Pavlov, 2024). Poor performance inhibits a student's educational journey; more severely, it can damage the student's confidence, career, and future. Students with performance issues experience stress, a decrease in motivation, and disengagement from learning. (Wang, B & Fornander, L., 2025). Performance issues also lead to numerous repeat enrollments, which negatively impacts universities financially. On a micro level, poor performance can lead to depression, a loss a motivation, and low self-esteem in an individual. (Luzipo, N. L., 2018)

The increased use of AI in learning and teaching has the potential to change the very essence of how teaching and learning is done. This is because it can provide instant learning support and customized materials. (Chen, 2020). As these technologies provide more and more opportunities for personalized learning, (Zhang & Chen, 2023), there is a need for the understanding of various elements that affect performance because these technologies are not effective for all learner segments.

Among these variables, personality traits play crucial, yet underexplored, roles in understanding how students adapt to and capitalize on AI-integrated educational tools.

Artificial Intelligence (AI) has the power to transform traditional academic learning modules into individualized experiences, thus enhancing students' academic learning. AI can be used to assess students' personalities and structure nuanced learning techniques in accordance with the students' different cognitive styles (Jang, H., 2024). Moreover, AI can simulate different learning experiences which can be used to enhance students' thinking and problem-solving skills. The successful integration of the available AI technology in the academic sector is based on how effectively the learners' ethical concerns are addressed, assurance of algorithm transparency, and development of confidence in AI learning tools. Exploring the emerging realities of the relationship between personality assessment, ethical concerns of AI, and problem-solving skill development can help in leveraging students' academic learning.

III. LITERATURE REVIEW

Big Five Personality Traits and Academic Achievement

The Big Five personality model has been key factor for examining the relationship between personality traits and academic success. Openness to experience is the trait used to define a person's ability to be creative and inquisitive, appreciate new ideas, and be accepting of new beliefs and values. Openness to experience defines a person's ability to seek new activities, appreciate new ways of thinking, and enjoy new experiences (Mount & Barrick, 1995). People with high levels of this trait tend to be attracted to creative and unconventional ideas. They also show greater emotional reactivity. This reactivity can lead to the perception of emotions and experiences at a high level as positive or

negative. High levels of this trait provide the person with the ability to understand their emotions and appreciate the world around them more fully (Madrid & Patterson, 2016).

Extraversion as a dimension of personality is characterized as the predisposition by individuals to act with energy, enthusiasm, and eagerness. Individuals that score highly on the extraversion dimension are active, lively, and always ready to undertake new activities. They are very passionate about the interest and the activities they undertake. This dimension includes an array of behavioural patterns that reflect a willingness to take risks, a preference for variety of external stimulation, sociability coupled with assertiveness, and high energy expressed in acts of verbosity (Kandler et al., 2016). Individuals with high extraversion are generally confident, positive, and independent, and are not very willing to adhere to the instructions of other people. The dimension is characterized by a high degree of positive emotionality and is widely believed to be associated with high degree of positive affect. Extraversion is characterized by a preference for social interactions and engagement, a lot of positive emotionality, and often is associated with positive feelings of joy, enthusiasm, and high motivation (Clark & Watson, 1991).

Previous studies on the connection between university students' levels of Extraversion and their academic performance have generally not yielded conclusive results. Research has found that educational results tend to be inversely related to Big Five Extraversion. This indicates that greater degrees of the trait are related to poorer academic performance (Müller, E., 2012). One way to understand this inverse relationship could be that people with Extraversion tend to focus greater on social activities. They tend to be more drawn to and more satisfied by stimulating and exciting activities and social company, and they may end up spending less time on academics than the more introverted students (Lievens, F., Ones, D.S. & Dilchert, S., 2009).

Those with elevated scores on the conscientiousness scale are typically very organized and demonstrate a high degree of goal-orientation. They tend to be persistent in the pursuit of high standards and self-improvement (Goldberg, 1990). Evidence indicates that conscientiousness and its subcomponents, achievement striving and self-discipline, positively correlate with grade point averages and postsecondary outcomes. Achievement striving and self-discipline are the most significant predictors of academic success (Poropat, 2009). Students with higher levels of conscientiousness can be easily recognized by their goal-driven attitude and overall precision and attention to detail in all of their academic work. The key components of conscientiousness are positively correlated with students' overall performance in a wide variety of both formative and summative assessments. Their determination to conquer challenges and their organized and precise work habits are key differentiators of their success (De Feyter et al., 2012).

Personality and Problem-Solving Abilities

The research shows that common mynahs' personality traits, such as being exploratory or competitive, are positively correlated with their problem-solving abilities. When it comes to solving problems, highly exploratory individuals can be innovative and gather new, relevant

information. In contrast, individuals who are less exploratory may have to rely on trial-and-error behaviour more (Griffin et al., 2017). The findings challenge the idea that social problem-solving is the result of learned behaviours. Instead, they recognize the role of personality in social problem-solving. From this perspective, specific strategies to address social problem-solving deficits are needed (D'Zurilla et al., 2010). For example, highly neurotic individuals may need emotional management strategies designed to help regulate their negative emotions, whereas those with lower openness may benefit from engaging in creativity-based interventions. A meta-analysis in the study found that Agreeableness and Openness positively correlated with problem-solving strategies. However, Neuroticism negatively correlated with problem-solving strategies, stemming from avoidance behaviours. Conscientiousness positively correlated with strategies directed toward competing behaviours (Tehrani & Yamini, 2020).

Personality and Ethics in Academic achievement Contexts

One line of research examines the connection between Extraversion and its impact on emotions, moral judgment, and behaviour in social situations. Extraverted people enjoy and succeed in social situations, which often provide them with a variety of emotional experiences. They become more active and responsive to positive emotions and may bring them to a good and enthusiastic approach to situations. This tendency can influence their happiness and emotional outlook and moral judgments. They often look at a situation in the context of cooperation and mutual benefit. (Wilt, J., & Revelle, W., 2009).

A separate study (O'Connor and Paunonen, 2007) examines the importance of the dimensions of personality "Conscientiousness" and "Openness" in the context of creating "honesty" and "responsibility" in the classroom. A student who is more conscientious is said to be person who is very professional and is more systematic and thorough in their work. In the classroom, the student who is conscientious exhibits the attributes of punctuality and his/her ability to meet deadlines in a firm (O'Connor, M. C., and Paunonen, S. V., 2007) manner. A conscientious individual is hard working and is self disciplined and thorough and is very committed to his/her work. In the classroom, students who are conscientious are honest and very strict and thorough in the scholarly work and always ensure that they do not engage in academic dishonesty Komarraju, et al., (2011) and deception.

AI-based Detection of Ethical Tendencies and Moral Reasoning

Implementing ethical practices in the early stages of design, the goal of this research is to avoid the threat of imbalanced outcomes, privacy violations, and compromising an individual's autonomy. The research emphasizes fully integrating the computer scientist, ethicist, and policy maker, as a way of designing artificial intelligence that fits within the boundaries of societal norms and ethical practices (Anderson, M., & Anderson, S. L., 2007). As indicated, the adaptive use of various disciplines is critical in addressing the configuring ethical challenges in the domain as it brings

together all the various stakeholders. These include computer scientists, moral philosophers, educators, and social scientists. Through these collaborative arrangements, stakeholders will have actionable and concrete ideas that provide for the ethical use of AI in education, addressing the ethical challenges of a broader societal scale (Holmes et al., 2022). AI ethics in this framework, positioned philosophically, stresses the demand of an inclusive system of AI with a consideration for a diversified learner disposition, and an intentional avoidance of a system that is biased. Additionally, it spells out the role of the educator as the bastion of critical and reflective thinking, protecting learners from the intrusiveness of AI systems. This approach creates a critical balance between the ethical use of AI and the empowerment of the users of AI systems. (Karpouzis, K., 2024).

IV. METHOD

This literature review employs a narrative methodology which synthesizes research in an identified area in a flexible way. Narrative reviews are different to systematic reviews or meta-analyses which have rigorous, defined parameters for the inclusion of studies or statistical analyses. Narrative reviews allow researchers to examine findings across a range of studies and discuss their findings in a way that is cohesive and organized thematically (Baumeister & Leary, 1997).

There are a number of reasons for employing the narrative methodology here. Firstly, this research is located at the nexus of personality, academic achievement, problem solving, and ethics in relation to artificial intelligence within the education system. This is a cross-disciplinary topic, and so a narrative review is useful as it allows the researcher to integrate studies that span disciplines, which have different methodologies and theoretical frameworks (Green et al., 2006). Secondly, the narrative methodology permits the researcher to go beyond the literature and identify overarching themes, and key gaps and contradictions, rather than being confined only to measurable effect sizes.

For this review, relevant literature was extracted using several academic databases, including Scopus and Google Scholar. Databases like Web of Science were also used. Keywords included "problem solving," "Big Five," "AI in education," and "integrity in education." 20-25 key references were selected based on their credibility and contribution to the discussion. The results were organized thematically and comprised the following four sections: personality and performance, personality and problem solving, personality and behavioural ethics, and the role of AI in education. Each section analyzes the studies critically, notes the consensus and controversy among the studies, and adds new connections to the studies. The result of this approach is a detailed, organized, and theory-based analysis of what is known in this growing field.

V. FINDINGS

The existing literature generates multiple key insights on the interrelatedness of traits, academic performance, problem-solving skills, and the role of AI in education. Regarding personality and academic performance,

concerning traits, the dimension of self-discipline in achieving goals is the most significant and dependable determinant of higher education outcomes. Conscientious learners are goal-oriented and highly focused, which brings them high results in different kinds of assessments. On the other hand, Extraversion is primarily negatively related to academic performance in higher education, as extraverts' preference for socializing, being on the go, and engaging in interpersonal activities takes away the time they should spend on studying (Müller, 2012; Lievens et al., 2009).

Regarding personality and problem-solving, traits such as exploratory inclination and competitiveness positively correlate with problem-solving skills. It is noted that highly exploratory people are able to provide creative solutions as a result of quick environmental exploration, whilst their less exploratory counterparts are more focused on problem-solving through a series of experiments (Griffin et al., 2017). Following a meta-analysis of 20 articles, the authors argue that Openness is a predictor of integrating problem-solving techniques, Agreeableness is linked to compromising techniques, Conscientiousness is related to competing techniques, and Neuroticism is linked to avoidance in reaching a solution (Tehrani & Yamini, 2020). They argue that, for example, the implementation of a creative training program for neurotic people in order to regulate their emotions and for people with low Openness, can improve problem-solving skills.

On the ethical front, Conscientiousness and Openness deeply affect moral actions in the field of education. Conscientiousness is an important value for academic honesty. Such individuals do not engage in acts of plagiarism and dishonesty. According to research, Conscientious individuals avoid plagiarism and dishonesty. The role of Extraversion here is that positive emotions help people to make peer orientation ethical (Wilt & Revelle, 2009).

Lastly, On the integration of AI in education, there is a need for concrete interdisciplinary integration of computer scientists, ethicists, and policy makers. This would ensure transparency and inclusiveness while aligning with the value systems of society (Anderson & Anderson, 2007; Holmes et al., 2022; Karpouzis, 2024).

VI. DISCUSSION

The results of this analysis demonstrate the effects of personality on academic performance, the ability to solve problems, and the display of certain behaviours in different environments such as a classroom or school. Of the Big Five personality factors, Conscientiousness is the most established factor in predicting academic performance and is related to the achievement striving and self-discipline that pushes students toward a goal or achievement (Poropat, 2009). In a related way, disciplined and organized students utilize their time smarter and surpass students without those characteristics (De Feyter et al., 2012). When combined with the Big Five, E vs. I (Extraversion vs. Intraversion) will likely produce a negative outcome regarding academic performance, due in part to students with higher social engagement and sensation seeking likely spending less time studying (Müller, 2012; Lievens et al., 2009). Positive emotionality, a branch of Extraversion, Leans positively toward cooperative ethical judgments. This suggests that

personality can yield different results depending on what is being evaluated (Wilt & Revelle, 2009).

With problem-solving, evidence shows personality factors play a role in determining the choice of strategies. Openness involves more integrating strategies, whereas avoidance strategies may be the result of Neuroticism, and compromising may result from higher Agreeableness (Tehrani & Yamini, 2020). This shows problem-solving strategies extend beyond the cognitive domain and are linked closely to dispositions (Griffin et al., 2017). As a result of this links between personality and problem-solving, targeted strategies like training to regulate emotions for those higher on the Neuroticism may enhance problem-solving (D'Zurilla et al., 2010). The other dimension shows that Conscientiousness and Openness may promote academic integrity and responsible behaviour (Komarraju et al., 2011; O'Connor and Paunonen, 2007). As education more widely incorporates AI systems, interdisciplinary work is needed to make sure that the systems are designed in a way that incorporates and aligns with the needs of society and the different diverse needs of the learners (Anderson & Anderson, 2011; Holmes et al., 2022; Karpouzis, 2024).

In short, personality traits are primary within education, requiring focus in teaching practice and the design of educational resources driven by AI.

VII. CONCLUSION

The review is not without its limitations. First, self-reported personality measures are the largest body of research cited, and response and non-response biases (like social desirability) threaten the integrity of character evaluation. Second, most of the research considered is cross-sectional and, therefore, does not allow for firm conclusions about the relationship between personality and academia. Third, the review largely glosses over the range of character and academic realities across the world, and therefore, limits the scope of the findings. Fourth, the fast-paced, dynamic change of AI tools in the field of education places some of the cited research in the realm of 'out-of-date' ethics and declining technology. Finally, the review includes an overwhelming majority of research done within a Western (mostly Anglo) context.

For more comprehensive results, future studies should employ more permanent designs. Personality and academia could be more richly captured if various forms of data (like assessment by peers and behavioural observations) are adopted in addition to the self-reported measures. There should be a strong emphasis on multicultural studies that investigate the multitude of character-academics intersections across different and separated civilizations. In addition to this, personality profiling of students to inform AI-driven educational tools offers a more ethical and creative solution to potential dilemmas arising from the abuse of AI in education. The incorporation of creativity-focused workshops for lower-openness students demonstrates a valid and well-tailored intervention to be integrated into real-world educational settings.

REFERENCES

- Anderson, Michael, Susan, & Leigh. (2007). Machine ethics: creating an ethical intelligent agent. *Ai Magazine*.
- Aristovnik, A., Kerzic, D., Ravselj, D., Tomazevic, N. and Umek, L. (2020), "Impacts of the COVID-19 pandemic on life of higher education students: a global perspective", *Sustainability*, Vol. 12 No. 20, pp. 1-16.
- Baumeister, R. F., & Leary, M. R. (1997). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 122(3), 497–529.
- Chen, X., Xie, H., Zou, D. and Hwang, G.J. (2020), "Application and theory gaps during the rise of artificial intelligence in education", *Computers and Education: Artificial Intelligence*, Vol. 1, 100002.
- Clark, L.A. and Watson, D. (1991), "Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications", *Journal of Abnormal Psychology*, Vol. 100 No. 3, pp. 316-336.
- De Feyter, T., Caers, R., Vigna, C., & Berings, D. (2012). Unraveling the impact of the Big Five personality traits on academic performance: The moderating and mediating effects of self-efficacy and academic motivation. *Learning and Individual Differences*, 22, 439-448.
- D'Zurilla, T. J., Maydeu-Olivares, A., & Gallardo-Pujol, D. (2010). Predicting social problem solving using personality traits. *Personality and Individual Differences*, 49(7), 731–736.
- Golberg, L.R. (1990), "An alternative description of personality: the big-five factor structure", *Journal of Personality and Social Psychology*, Vol. 59 No. 6, pp. 1216-1229.
- Green, B. N., Johnson, C. D., & Adams, A. (2006). Writing narrative literature reviews for peer-reviewed journals: Secrets of the trade. *Journal of Chiropractic Medicine*, 5(3), 101–117.
- Griffin, A. S., Peneaux, C., & Lermite, F. (2017). Personality and problem-solving in common mynas (*Acridotheres tristis*). *Behavioural Processes*, 134, 87–94.
- Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2022). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education*, 32(3), 504–526.
- Jang, H. (2024). An AI-Powered Mobile-Assisted Language Learning: A Systematic Review. (Thesis). University of Western Ontario.
- Kandler, C., Riemann, R., Angleitner, A., Spinath, F., Borkenau, P. and Penke, L. (2016), "The nature of creativity: the roles of genetic factors, personality traits, cognitive abilities, and environmental sources", *Journal of Personality and Social Psychology*, Vol. 111 No. 2, pp. 230-249.
- Karpouzis, K. (2024). Artificial Intelligence in Education: Ethical Considerations and Insights from Ancient Greek Philosophy. In *Proceedings of 1st Workshop on Responsible Artificial Intelligence (ReAI '24)*.
- Komarraju, M., Karau, S. J., Schmeck, R. R., & Avdic, A. (2011). The Big Five personality traits, learning styles, and academic achievement. *Personality and Individual Differences*, 51(4), 472–477.
- Lievens, F., Ones, D.S. & Dilchert, S. (2009). Personality scale validities increase throughout medical school. *Journal of Applied Psychology*, 94 (6), 1514-1535.
- Luzipo, N. L. (2018). Social factors that contribute to poor academic performance of second-year nursing students at a public nursing college. (Thesis). Nelson Mandela Metropolitan University.
- Ma, Y. (2021). Assessing Student Achievement in Probability Problem Solving Using Collaboration Process Data: Development and Use of a Scoring Rubric. (Doctoral Dissertation). Columbia University.
- Madrid, H.P. and Patterson, M.G. (2016), "Creativity at work as a joint function between openness to experience, need for cognition and organizational fairness", *Learning and Individual Differences*, Vol. 51, pp. 409-416.
- Mount, M.K. and Barrick, M.R. (1995), "The big five personality dimensions: implications for research and practice in human resources management", *Research in Personnel and Human Resources Management*, Vol. 13 No. 3, pp. 153-200.
- Müller, E. (2012). The big five model of personality and academic achievement at university. (Thesis). University of Johannesburg.
- O'Connor, M. C., & Paunonen, S. V. (2007). Big Five personality predictors of post-secondary academic performance. *Personality and Individual Differences*, 43(7), 1798–1808.
- Pavlov, J. (2024). Umělá inteligence ve školství: Artificial intelligence in education. (Thesis). Brno University of Technology.
- Poropat, A.E. (2009), "A meta-analysis of the five-factor model of personality and academic performance", *Psychological Bulletin*, Vol. 135 No. 2, pp. 322-338.
- Ranjeet Nambudiri, Rihana Shaik and Swati Ghulyani(2020). Student personality and academic achievement: mediating role of psychological capital (PsyCap). *International Journal of Educational Management* Vol. 34 No. 4, 2020 pp. 767-781.
- Shangyu Li.(2024).Exploring the Impact of University Counselors' Big Five Personality Traits on Students' Academic Performance in Yunnan.*International Journal of Social Science and Education Research*(10),353-357.
- Swart, E. (2021). The relation between personality types and academic performance amongst Grade 9 learners in Windhoek. (Thesis). University of Namibia.
- Tehrani, H. D., & Yamini, S. (2020). Personality traits and conflict resolution styles: A meta-analysis. *Personality and Individual Differences*, 157, 109794.
- Wang, B., Deighton, J., & Fornander, L. (2025). Peer victimization, learning flow, and academic achievement: Longitudinal relations among Chinese elementary school students. *Journal of Educational Psychology*.
- Wilt, J., & Revelle, W. (2009). Extraversion and its positive emotional core. In M. Leary & R. Hoyle (Eds.),

- Handbook of individual differences in social behaviour (pp. 275–293). Guilford Press.
- Yuhong Zhang & Kefang Chen. (2023). Improving the Quality of English Talents Cultivation in Chinese Private Colleges and Universities in the Data-driven AI Age. *Journal of Big Data and Computing*(2).
- Zheng, Y. (2024). Uncovering Learning in Maker Education: Employing Collective Documentation and Natural Language Processing to Identify Knowledge Construction in Complex Open-Ended Learning Environments. (Doctoral Dissertation). Columbia University.