## **Comparison between Traditional (Passive)** Learning and Active Learning

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Active learning has been increasingly important in tertiary education due to its powerfully favourable impact on students' learning attitudes and efficacy. The way that a classroom is set up has a direct impact on how well students learn and how well teachers teach. The continuous evaluation of students' learning performance is essential for guiding future classroom renovations and creating a cutting-edge learning environment for both students and teachers.

traditional learning

active learning

design factors

design criteria

built pedagogy

### **1. Introduction**

The traditional classroom design has been the premiere environment for facilitating learning at the primary, secondary and tertiary education levels. The traditional classroom design is structured such that it encourages a fixed seating configuration of students. Thus, students are positioned as listeners of the instructor. The notion of the 'sage on the stage' by <sup>[1]</sup> portrays the traditional classroom design and its learning approach. Teachers become the main source of knowledge, while students are passive absorbers of such knowledge at the preaching of their teachers <sup>[2]</sup>. Aside from listening to lectures, other participatory activities such as small group discussion, cooperative learning and peer questioning are discriminated against because of the traditional classroom design. Rather, information delivery is mostly one-way—from the instructor to the listeners—apart from the listeners asking the instructor s to complete the delivery of their syllabus for the adequate assessment of learners. However, this form of design has been criticised as not effective for student engagement. It affects skills development concerning collaboration, interpersonal communication and confidence in public speaking. These are essential skills for the corporate world. Due to these lapses in the traditional classroom design and its learning approach, policymakers are drifting towards active classroom design and learning.

Contemporary pedagogy requires a transition to a better learning approach, and this is active learning. Active learning is a broad and commonly used term generally defined as "any instructional method that engages students in the learning process" <sup>[3]</sup> (p. 223). The theoretical basis of active learning is constructivism, which posits that people build knowledge by acting on the world around them and reflecting on their actions and experiences; that is, knowledge of an object is inseparable from the people or subject studying the object or processing the object. Active learning is, therefore, more learner-centred and requires more physical activities by the learner. Studies have recommended that instead of passively receiving and interpreting information, students should rather actively

engage by acting on objects to gain knowledge of the objects (i.e., the active learning approach) <sup>[2][4][5][6][7][8]</sup>. The recommendations for active learning by both teachers and students have been buttressed by engagement with course content, the promotion of retention and mastery of content as some benefits of active learning to students <sup>[9]</sup>. For instance, group discussion helps students to acquire essential skills for their future careers; it enhances students' communication skills <sup>[8]</sup>.

Pedagogical strategies such as case studies, roleplaying, internships, simulation, team projects, peer tutoring and challenging discussions could be employed for active learning <sup>[4]</sup>. In addition, multimedia learning visuals can be used to promote active learning <sup>[5]</sup>. Moreover, casual group learning can be an effective strategy for active learning <sup>[6]</sup>. Although some of these active learning strategies could be conducted in the traditional classroom setting, effectively implementing the active learning strategies for their benefits requires a classroom that better promotes active learning. Active learning classroom designs have variant forms such as the student-centred Active Learning Environment, Technology-Enabled Active Learning (TEAL) and Space to Transform, Interact Learning, Engage (TILE) <sup>[10]</sup>. The commonality of all forms of active learning classroom design is that they feature tables with movable seating which facilitates group work such as small group discussion, cooperative learning and peer questioning <sup>[10]</sup>. The instructor mostly plays a facilitative role to enable learning and information sharing among learners. Consequently, this form of classroom design promotes effective interpersonal communication and collaboration, which are 'skills and dispositions deemed necessary for a lifetime of learning' <sup>[11]</sup>.

## 2. Active Learning

The architecture of the classroom reflects the educational philosophy and ideology, and the learning environment affects students' study attitudes <sup>[2][12]</sup>. Given how quickly current technology is developing, there has been a substantial shift in pedagogical practices in recent years. The increasing accessibility of interactive learning platforms, the abundance of high-quality content online, and the simplicity of connecting mobile devices to the internet are some of the factors driving the pedagogical revolution <sup>[13][14]</sup>. In the workplace, the capacity to use interpersonal skills and good communication skills is essential, and these skills can be strengthened through education. Consequently, the teaching approach has been shifting away from the traditional teacher-centred teaching style towards a more active form with students' engagement and interaction in group discussions, especially in tertiary education <sup>[6][7][8][15][16]</sup>.

The conventional learning environment, which is set up in a constant lecture-style configuration, restricts how students learn and how they consider what they are learning <sup>[17]</sup>. The arrangement of traditional classrooms, which are often big and have a screen or blackboard in the front, makes it simple for teachers to convey information. Most of the time, students pay close attention to the monitor so they may learn from the teacher and take notes. Throughout an entire lecture, there are few interactions between instructors and students, as well as few student-to-student discussions. The classroom's monotonous design causes boredom and creates distance between students and teachers <sup>[12]</sup>. The set furniture layout makes it physically difficult to have a group discussion or other interactions, which reduces the opportunity for the free flow of ideas. Due to the traditional teaching method's

single delivery of knowledge and information, there is a higher likelihood that cognitive laziness will occur. Students' ability to learn is impacted by this, necessitating an active learning strategy.

According to [15][18], active learning is a method of instruction that emphasises critical thinking and involves students doing things while also thinking about what they are doing. The focus of active learning is on the use of contemporary technology, which makes it possible to teach some challenging ideas using dynamic and spatial picture technology. There are many technologies that help teachers to deliver knowledge in different ways [5]. A teacher can explore various tools and videos from modern technology and combine them with the class's main idea to explain a complex concept in a way that is more visually stimulating and encourages active learning. Examples of modern technology include smartphones, computers and virtual reality. With beneficial devices, teachers can also provide more learning opportunities. Active learning allows instructors to share information in a more imaginative manner by adopting modern technology to enhance the quality of education. A requirement for design in an active learning classroom is the flawless control of battery power and many wireless devices. The teaching and learning methods have been affected by the rapid development of communication technologies. For instance, a mobile phone has evolved into a minicomputer that allows users to quickly access various applications or communication platforms. This makes interactive classroom activities easier to carry out [19]. For instance, Kahoot! is a well-liked and widely used online learning platform that is practical for classes to improve student engagement, vitality, interaction and metacognition in tertiary education classrooms <sup>[20]</sup>. The development of this kind of online platform is based on the widely used user-centred and behavioural design methodologies. The usage of Kahoot! to collect student responses is evidently appreciated and well-received by them. Instructors and lecturers have the option to modify their subject in many disciplines based on students' understanding and expertise on brief tests since it provides real-time responses and feedback <sup>[21]</sup>. In addition, these platforms permit anonymous participation, which increases student involvement [4][8]. Access to the platforms needed to complete interactive activities is simple for classes with modern technology. In addition to mobile technology, flexible furniture is a key success factor for active learning pedagogies [12][17][22][23].

The design of a learning space, which includes both technical support and classroom amenities, is a key element in achieving the benefits of active learning <sup>[2][4][24]</sup>. At the same time, teachers must collaborate when utilising the resources offered to implement active learning effectively and enhance students' knowledge construction. The classroom design had a significant positive impact on students' ability to solve problems, as well as on fostering conceptual understanding and better learning attitudes, according to a project at North Carolina State University which implemented studio-based, collaborative learning to large classes <sup>[25]</sup>. Good desk and chair placement in the classroom can increase student participation and provide them with more opportunities to give feedback during class. Round tables, for instance, might encourage interactions between teachers and students as groups of pupils work cooperatively on engaging projects. Additionally, a pleasant learning environment with acceptable air quality and adequate lighting from natural daylight is crucial for students' achievement in their academic studies <sup>[12][26]</sup>. Students are more inclined to spend time in class when they feel at ease <sup>[22][23]</sup>, which increases learning progress and learning motivation.

Additional educational tools that complement the active classroom include social media, online courses, online learning platforms and virtual reality <sup>[27][28]</sup>. In some institutions, the flipped classroom is adopted, through which, course contents are shifted to online materials that students are expected to learn on their own, while the students spend in-class time with their instructors on activities to analyse, apply and consolidate the content learned online <sup>[26]</sup>. This approach promotes better interaction between students and their instructor, facilitates challenging discussion among students and ensures peer tutoring which could enhance interpersonal communication <sup>[29]</sup>. Although active learning is mostly conducted via a face-to-face classroom environment, it is worth noting that it could also be carried out via online tools, viz: Zoom, MS Teams, Skype and Google Meet. Through these tools, screen sharing for individual or group presentations, online discussion boards and Zoom breakout rooms and peer feedback assignments can be conducted to promote interactions among students and between the instructor and students <sup>[4]</sup>. These online tools became very essential during the global COVID-19 pandemic era; although face-to-face meetings were discouraged, active learning was ensured through online tools.

The advancement of educational technologies has brought about a new style of instruction and learning that has tremendously influenced educational institutions such as universities and colleges to adopt pedagogical reform. The modification of the classroom layout has evolved into a crucial step in obtaining success for active learning because of the pedagogical change. New teaching approaches cannot be used in traditional classrooms because they are made to merely provide knowledge to pupils. In accordance with the current development, teachers will use various types of technology to provide instructional materials, films and other new tools to students. As a result, new classrooms typically need additional space for equipment, and both students and teachers need to have easy access to it. Additionally, the active classroom method encourages students to participate more actively in debates, exchanges and reactions with teachers and their fellow students. To support and assist students in using the new technology for learning and evaluation, the teacher may also circulate the room. Flexible and accessible classroom design is therefore of utmost importance to accommodate the high demand for interactions between students and teachers. The new pedagogical change is thought to benefit from layout design features such as wider aisles and furniture features such as movable seats and tables, which influence built pedagogy [127][22][23][30][31].

Built pedagogy denotes the space's capacity to support the teaching and learning approach. The authors of <sup>[32]</sup> advocated that a well-designed classroom is one of the most important things to help and support active and cooperative learning because it gives students a good place to learn for both educational and social reasons and makes the most of the space. The focus should be on (i) functionality (adaptability and flexibility), (ii) comfortability, (iii) user-friendliness and (iv) aesthetics when designing an active learning environment <sup>[33][34]</sup>. Classrooms should be arranged and designed (i) to cooperate with technology, services and contents in a physical manner, which can encourage students to work and collaborate with others; (ii) to be set up with varieties of technologies; (iii) to facilitate group collaborative work in different group sizes; and (iv) to enhance adaptability and flexibility and support a multi-functional learning environment <sup>[35][36]</sup>.

# **3.** Comparison between Traditional (Passive) Learning and Active Learning

### Traditional (Passive) Learning, Its Advantages and Disadvantages and How It Affects Learning Space Design

Traditional (passive) teaching refers to the teacher-centred teaching approach that places a focus on providing students with information in a one-way manner (**Table 1**). For the design of a traditional classroom, a teacher stand is usually placed in the front and long tables for students face the front stand, which forms an authoritative position which means that teachers can monitor and ensure their students' seats remain stationary and arranged in rows <sup>[37]</sup>. As pupils take a passive role in absorbing knowledge and information, this setup is discovered to be more ideal for the memorisation of facts and coursework with a theoretical focus. The opportunity for practice may be limited with traditional learning methods. Because students may easily learn from what professors have prepared and from book information, programmes that use a traditional teaching methodology tend to have fewer practical skills. Additionally, the one-way knowledge transmission function discourages conversation between students and between teachers. However, including a discussion component in a class offers numerous advantages. Interpersonal skills, often known as soft skills, are vital in the workplace and include listening, communication, cross-cultural connection and team problem-solving skills, among other things <sup>[38]</sup>. The insufficient development of these talents is a drawback of adopting traditional learning. Student discussion opportunities are limited in traditional teaching methods.

According to <sup>[39]</sup>, the term "active learning approach" refers to "pedagogies of engagement" that promote greater levels of knowledge transfer, comprehension and application. With the use of group discussions, roleplaying, case study instruction, problem-based learning and other techniques, the active learning approach strives to actively engage students <sup>[11]</sup>. The active learning strategy is a simulation approach with four distinguishing features: (i) an exploration for understanding and meaning, (ii) attention towards student responsibility, (iii) an understanding of knowledge and skills and (iv) a strategy to the curriculum which goes beyond graduation to a far-reaching social and career setting. While the teacher's direction is still crucial in the active learning approach, a higher level of student accountability can be attained through active learning.

It is thought that active participation in class has a substantial impact on students' academic progress. Students are thoroughly involved in active learning activities rather than superficial learning, which helps students effectively transfer and apply knowledge since those activities promote higher-level thinking skills <sup>[10]</sup>. By spiritually encouraging students to communicate opinions from personal viewpoints through team interactive activities, the learning experience of the students can be improved <sup>[40]</sup>. By stimulating psychological and cognitive processes, active learning strategies encourage critical thinking <sup>[41]</sup>. A person who applies intellectual standards and criteria to their cognition regularly and systematically is said to be engaging in critical thinking <sup>[42]</sup>. Critical thinking is a process that aids in decision-making and is becoming more and more important in society. Using an active learning technique could boost students' competitiveness. However, helping students acquire their own knowledge through their own experiences rather than providing them with extensive materials and in-depth understanding is tertiary education's main problem. For active learning to be successfully implemented, intensive training and resources are key factors. In addition, there will be a few difficulties when applying active learning (refer to **Table 1**). Some

systems; whether or not assessment procedures should be changed or updated; whether or not there are enough faculties, resources and support services to implement an active learning approach; and whether or not students and professors who are used to a passive traditional learning mode will be willing to change <sup>[9][43]</sup>.

Mode of Learning	Category of Variable Under Consideration	Sources/References
Traditional Learning	Benefits of Traditional Learning	
	Direct information from teacher	[11][37]
	Timesaving (group discussion may waste time)	[ <u>11][17]</u>
	Allows more time for Q&A	[ <u>11][17]</u>
	Teaching conducted in an orderly manner	[ <u>11][17]</u>
	Understanding of the subject matter	[ <u>11][17]</u>
	Limitations of Traditional Learning	
	No collaborative learning atmosphere with other students	[10][39]
	Difficult to concentrate for long durations	[10][32]
	Less chance to allow students to express their ideas	[10][32]
Active Learning	Benefits of Active Learning	
	Direct information from teacher	[39]
	Timesaving	[10][39]
	Allows more time for Q&A	[10][39]
	Teaching carried out in an orderly manner	[10][39]
	Understanding of the subject matter	[32][42]
	Students learn collaborative skills	[32][39]
	Enables student engagement	[10][39]
	Promotes student interaction	[10][39]
	Students learn to think independently	[10][39]
	Students can learn from others	[32][39]
	Promotes learning motivation	[32][39]

Table 1. Design criteria for both traditional (passive) learning and active learning.

Mode of Learning	Category of Variable Under Consideration	Sources/References	
	Limitations of Active Learning		
	Difficult to control class order	[17][43]	
	Discussion is not focused	[17][43]	
	Time-consuming	[17][43]	
	Students prefer to work alone	[17][43]	
Designing of Classroom for Effective Teaching for Both Active and Traditional (Passive) Learning			
Designing of Classroom	Underlying Classroom Design Criteria	Sources/References	
Classroom Facilities	Types of facilities required in classroom		
	IT/AV provisions	[17][37][44]	
	Large monitors for presentation	[ <u>17][37]</u>	
	Internet access	[31][37][44][45]	
	Swirl chairs (for lecture theatres only)	[17][30][45][46]	
	Modular tables and movable chairs (for tutorial rooms only)	[12][17][23][46][47]	
Design Criteria	Criteria of classroom design to facilitate learning		
	Adjustable lighting	[12][22][23][26][48]	
	Adjustable temperature	[22][23][49][50]	
	Comfortable chairs	[17][30][31][51]	
	Vibrant colours	[12][22][23][24][26][52]	

### References

- 1. King, A. From sage on the stage to guide on the side. Coll. Teach. 1993, 41, 30–35.
- Bolden, E.C., III; Oestreich, T.M.; Kenney, M.J.; Yuhnke, B.T., Jr. Location, location, location: A comparison of student experience in a lecture hall to a small classroom using similar techniques. Act. Learn. High. Educ. 2019, 20, 139–152.
- 3. Prince, M. Does active learning work? A review of the research. J. Eng. Educ. 2004, 93, 223–231.
- Wright, M.C.; Bergom, I.; Bartholomew, T. Decreased class size, increased active learning? Intended and enacted teaching strategies in smaller classes. Act. Learn. High. Educ. 2019, 20, 51–62.

- 5. Roberts, D. Higher education lectures: From passive to active learning via imagery? Act. Learn. High. Educ. 2019, 20, 63–77.
- 6. Swanson, E.; McCulley, L.V.; Osman, D.J.; Scammacca Lewis, N.; Solis, M. The effect of teambased learning on content knowledge: A meta-analysis. Act. Learn. High. Educ. 2019, 20, 39–50.
- 7. Rezaei, A.R. Comparing strategies for active participation of students in group discussions. Act. Learn. High. Educ. 2022, 1, 14697874221075719.
- Clinton, V.; Kelly, A.E. Student attitudes toward group discussions. Act. Learn. High. Educ. 2020, 21, 154–164.
- 9. Smith, C.V.; Cardaciotto, L. Is active learning like broccoli? Student perceptions of active learning in large lecture classes. J. Scholarsh. Teach. Learn. 2011, 11, 53–61.
- 10. Baepler, P.; Walker, J.D.; Driessen, M. It's not about seat time: Blending, flipping, and efficiency in active learning classrooms. Comput. Educ. 2014, 78, 227–236.
- 11. Drew, V.; Mackie, L. Extending the constructs of active learning: Implications for teachers' pedagogy and practice. Curric. J. 2011, 22, 451–467.
- 12. Park, E.L.; Choi, B.K. Transformation of classroom spaces: Traditional versus active learning classroom in colleges. High. Educ. 2014, 68, 749–771.
- 13. Ehlers, U.D.; Schneckenberg, D. (Eds.) Changing Cultures in Higher Education: Moving Ahead to Future Learning; Springer Science & Business Media: Berlin/Heidelberg, Germany, 2010.
- 14. Vahedi, Z.; Zannella, L.; Want, S.C. Students' use of information and communication technologies in the classroom: Uses, restriction, and integration. Act. Learn. High. Educ. 2021, 22, 215–228.
- 15. du Rocher, A.R. Active learning strategies and academic self-efficacy relate to both attentional control and attitudes towards plagiarism. Act. Learn. High. Educ. 2020, 21, 203–216.
- 16. Reilly, C.; Reeves, T.C. Refining active learning design principles through design-based research. Act. Learn. High. Educ. 2022, 1, 14697874221096140.
- 17. Rands, M.L.; Gansemer-Topf, A.M. The room itself is active: How classroom design impacts student engagement. J. Learn. Spaces 2017, 6, 26–33.
- 18. Fink, L.D. Creating Significant Learning Experiences: An Integrated Approach to Designing College Courses; John Wiley & Sons: Hoboken, NJ, USA, 2013.
- 19. Friedman, L.W.; Friedman, H. Using social media technologies to enhance online learning. J. Educ. Online 2013, 10, 1–22.
- Plump, C.M.; LaRosa, J. Using Kahoot! in the classroom to create engagement and active learning: A game-based technology solution for eLearning novices. Manag. Teach. Rev. 2017, 2, 151–158.

- 21. Johns, K. Engaging and assessing students with technology: A review of Kahoot. Delta Kappa Gamma Bull. 2015, 81, 89.
- 22. Barrett, P.; Davies, F.; Zhang, Y.; Barrett, L. The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. Build. Environ. 2015, 89, 118–133.
- 23. Beckers, R.; Van der Voordt, T.; Dewulf, G. Learning space preferences of higher education students. Build. Environ. 2016, 104, 243–252.
- 24. Lei, S.A. Classroom physical design influencing student learning and evaluations of college instructors: A review of literature. Education 2010, 131, 128–134.
- 25. Beichner, R.J. History and evolution of active learning spaces. New Dir. Teach. Learn. 2014, 2014, 9–16.
- Nicol, A.A.; Owens, S.M.; Le Coze, S.S.; MacIntyre, A.; Eastwood, C. Comparison of high-technology active learning and low-technology active learning classrooms. Act. Learn. High. Educ. 2018, 19, 253–265.
- 27. Elmqaddem, N. Augmented reality and virtual reality in education. Myth or reality? Int. J. Emerg. Technol. Learn. 2019, 14, 234–242.
- 28. Hu-Au, E.; Lee, J.J. Virtual reality in education: A tool for learning in the experience age. Int. J. Innov. Educ. 2017, 4, 215–226.
- 29. Samuel, M.L. Flipped pedagogy and student evaluations of teaching. Act. Learn. High. Educ. 2021, 22, 159–168.
- 30. Tissenbaum, M.; Slotta, J.D. Developing a smart classroom infrastructure to support real-time student collaboration and inquiry: A 4-year design study. Instr. Sci. 2019, 47, 423–462.
- Tietjen, P.; Ozkan Bekiroglu, S.; Choi, K.; Rook, M.M.; McDonald, S.P. Three sociomaterial framings for analysing emergent activity in future learning spaces. Pedagog. Cult. Soc. 2021, 31, 17–36.
- 32. Alden Rivers, B.; Armellini, A.; Maxwell, R.; Allen, S.; Durkin, C. Social innovation education: Towards a framework for learning design. High. Educ. Ski. Work-Based Learn. 2015, 5, 383–400.
- 33. Harrison, A.; Hutton, L. Design for the Changing Educational Landscape: Space, Place and the Future of Learning; Routledge: London, UK, 2013.
- 34. Rook, M.M.; Choi, K.; McDonald, S.P. Learning Theory Expertise in the Design of Learning Spaces: Who Needs a Seat at the Table? J. Learn. Spaces 2015, 4, 17–29.
- 35. Lippincott, J.K. Linking the information commons to learning. Learn. Spaces 2006, 3, 1–10.
- 36. Ellis, R.A.; Goodyear, P. Models of learning space: Integrating research on space, place and learning in higher education. Rev. Educ. 2016, 4, 149–191.

- 37. Eradze, M.; Rodríguez-Triana, M.J.; Laanpere, M. A Conversation between Learning Design and Classroom Observations: A Systematic Literature Review. Educ. Sci. 2019, 9, 91.
- 38. Nealy, C. Integrating soft skills through active learning in the management classroom. J. Coll. Teach. Learn. (TLC) 2005, 2.
- 39. McCormick, A.C.; Kinzie, J.; Gonyea, R.M. Student engagement: Bridging research and practice to improve the quality of undergraduate education. In Higher Education: Handbook of Theory and Research; Springer: Dordrecht, The Netherlands, 2013; pp. 47–92.
- 40. Dewing, J. Becoming and being active learners and creating active learning workplaces: The value of active learning in practice development. Int. Pract. Dev. Nurs. Healthc. 2008, 273–294.
- 41. Popil, I. Promotion of critical thinking by using case studies as teaching method. Nurse Educ. Today 2011, 31, 204–207.
- 42. Ahmad, K.A.; Malik, F.Y.; Hulbert, J.R. Student preference for case studies: Enhanced learning in a human physiology course. Med. Sci. Educ. 2012, 22, 117–120.
- 43. de Novais, A.S.; Silva, M.B.; Muniz, J. Strengths, limitations and challenges in the implementation of active learning in an undergraduate course of logistics technology. Int. J. Eng. Educ. 2017, 33, 1060–1069.
- 44. Opre, D.; Şerban, C.; Veşcan, A.; Iucu, R. Supporting students' active learning with a computer based tool. Act. Learn. High. Educ. 2022, 14697874221100465.
- 45. Goodyear, P.; Carvalho, L.; Dohn, N.B. Artefacts and activities in the analysis of learning networks. In Research, Boundaries, and Policy in Networked Learning; Springer: Cham, Swizerland, 2016; pp. 93–110.
- 46. Henshaw, R.G.; Edwards, P.M.; Bagley, E.J. Use of Swivel Desks and Aisle Space to Promote Interaction in Mid-Sized College Classrooms. J. Learn. Spaces 2011, 1, n1.
- 47. Yeoman, P. The material correspondence of learning. In Spaces of Teaching and Learning; Springer: Singapore, 2018; pp. 81–103.
- 48. Wessolowski, N.; Koenig, H.; Schulte-Markwort, M.; Barkmann, C. The effect of variable light on the fidgetiness and social behavior of pupils in school. J. Environ. Psychol. 2014, 39, 101–108.
- 49. Almeida, R.M.; De Freitas, V.P. Indoor environmental quality of classrooms in Southern European climate. Energy Build. 2014, 81, 127–140.
- 50. Yang, L.; Yan, H.; Lam, J.C. Thermal comfort and building energy consumption implications—A review. Appl. Energy 2014, 115, 164–173.
- 51. Wingrat, J.K.; Exner, C.E. The impact of school furniture on fourth grade children's on-task and sitting behavior in the classroom: A pilot study. Work 2005, 25, 263–272.

52. Küller, R.; Mikellides, B.; Janssens, J. Color, arousal, and performance—A comparison of three experiments. Color Res. Appl. 2009, 34, 141–152.

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