June 2021

Achieving Learning Outcomes in Online Education

Sajjad Ismail
University of Windsor, ismailq@uwindsor.ca

Achieving Learning Outcomes in Online Education

by

Sajjad Ismail

A Major Research Paper

Submitted to

the Faculty of Graduate Studies through the

Faculty of Education

in Partial Fulfillment of the Requirements for

the Degree of Master of Education

at the University of Windsor

Windsor, Ontario, Canada

2021

Achieving Learning Outcomes in Online Education

by

Sajjad Ismail

APPROVED BY:

Z. Zhang

Faculty of Education

D. Martinovic, Advisor

Faculty of Education

March 29, 2021

DECLARATION OF ORIGINALITY

I hereby certify that I am the sole author of this major paper and that no part of this major paper has been published or submitted for publication.

I certify that, to the best of my knowledge, my major paper does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people included in my thesis, published or otherwise, are fully acknowledged in accordance with the standard referencing practices.

Furthermore, to the extent that I have included copyrighted material that surpasses the bounds of fair dealing within the meaning of the Canada Copyright Act, I certify that I have obtained a written permission from the copyright owner(s) to include such material(s) in my thesis and have included copies of such copyright clearances to my appendix.

I declare that this is a true copy of my major paper, including any final revisions, as approved by my thesis committee and the Graduate Studies office, and that this major paper has not been submitted for a higher degree to any other University or Institution.

ABSTRACT

Online education is proliferating fast for its many advantages, cost-effectiveness being one of the prime reasons. The most recent pandemic situation around the world has made it a serious and an urgent need. While there is a general agreement that online education is as good as face-to-face or better, except for some dissenting views, there is no literature available that can inform on the minimum essentials for achieving learning outcomes in online learning modality. This Major paper presents a synthesis of the latest studies on the most studied variables having significant effect on the online learning outcomes to extract the factors as 'necessary and sufficient' for a successful and satisfying online learning experience. This Major paper includes the resources on the school as well as post-secondary level online learning (thought there is extremely little empirical research available at K-12 level). The paper also finds intricate nature of these variables and mediators that are mutually reinforcing and creating synergy towards improved learning outcomes.

Key words: online education, distance education, learning outcomes, quality education, moderating variables, class-size, learning behavior, teacher interaction.

DEDICATION

Dedicated to the principals, teachers, parents, and children who are supporting each other to adopt to the virtual learning environment and are making collective and individual efforts to make online learning a successful experience.

This major paper is also dedicated to the marginalized and excluded children, and to those children whose education is interrupted by the disasters around the world, for whom online education is a hope for the provision of inclusive and uninterrupted quality education.

ACKNOWLEDGEMENTS

I take this opportunity to submit my sincere thanks to all those without whose support it would not have seen the light of the day. First, and the foremost, I am extremely thankful to my academic advisor Dr. Dragana Martinovic who has been so patient and encouraging during all this time. Her academic and technical insight as well as much needed timely advice has been guiding me through the challenges throughout this research work. I am also thankful to Dr. Zuochen Zhang whose feedback helped me fine tune my work.

Lastly, I am thankful to my wife Dr. Alia Sajjad whose moral support has always been there and who has been sharing my family related responsibilities time and again so that I can have time to focus on my paper with my daily routine job.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Today's online education has evolved from distance education that relied on correspondence, educational television, telephone and other means of slower and mostly one-way communication. The pedagogical approach in initial three generations of distance education (as categorized by Taylor, 2001) was limited to expository or didactic, as dictated by the available technological options and their constraints. With the advent of Information and Communication Technologies (ICT) and their fast development in a very short period of time, like all other aspects of life, education was also affected. The ICT have offered new options to distance learning such as swift exchange of messages, multiple-way communication, and choices in pedagogical approaches. According to Rudestam and Schoenholtz-Read (2010), advocates of online learning value it for the improved learning experience based on ICT-supported interactivity, social networking, collaboration, and reflection (as cited in Means et al., 2013, p. 3). As stated by Eady and Lockyer (2013, p. 6), "The important role that technology plays in education gives teachers the opportunity to design meaningful learning experiences that embed technology," and there are endless possibilities, they add. Similarly, Panagiotis and Nikolarea (2012) observe that "research data show that ICT can enhance pupils' performance in school subjects" (p. 22).

Online learning evolved from the distance model of education improved over time with the technological progress and refinement. "Online learning overlaps with the broader category of distance learning, which encompasses earlier technologies such as correspondence courses, educational television, and videoconferencing" (Means et al.,

2013, p. 3). It is considered the most modern form of distance learning, also referred to as 'fifth generation distance education,' which is "essentially a derivation of the fourth generation, which aims to capitalize on the features of the Internet and the Web" (Taylor, 2001, p. 2). Online modality of education has the capacity to transcend the existing outreach levels, and at much lower costs.

> The fifth generation (Intelligent Flexible Learning) model of distance education… has the potential to provide students with a valuable, personalized pedagogical experience at noticeably lower cost than traditional approaches to distance education and conventional face-to-face education. [It] has the potential not only to improve economies of scale but also to improve the pedagogical quality and responsiveness of service to students. (Taylor, 2001, p. 12)

Distance education, offering courses through correspondence prior to the technological revolution, was traditionally considered an inferior mode of education compared to face-to-face education in terms of quality. Though offering flexibility of learning, it was never the first choice of students who could have access to a formal school, and who could afford it in terms of time and cost. Today, online education is the serious competitor, thanks to the technological revolution. As observed by Nguyen (2015), "The physical 'brick and mortar' classroom is starting to lose its monopoly as the place of learning" (p. 309).

ICTs have impacted the distance education and the face-to-face education equally forcefully. The amazing potential and everyday unraveling new possibilities in pedagogy with ICT have captured the attention of education researchers and practitioners to adopt them in traditional face-to-face education as well, making it blended or hybrid education. "Innovative technologies not only have the potential to evolve pedagogical practice, but also completely transform entire learning environments" (Groff, 2013, p. 8). Experts are experimenting with the technology to improve the overall learning experience of the

learners. For example, Nguyen (2015) observed that "The Internet has made online learning possible, and many researchers and educators are interested in online learning to enhance and improve student learning outcomes while combating the reduction in resources, particularly in higher education" (p. 309).

Current Situation

Nowadays, online education is a common phenomenon even at K-12 level and a large number of schools are offering online courses side-by-side with face-to-face courses. Students are taking online courses of their choices as first timers or as retake for credit recovery. ICT integration into face-to-face learning is very common in North America, offering hybrid or blended education in private and public educational institutions. While universities are mostly offering both campus- based and online courses, there are also an increasing number of schools that are fully online. For the academic year 2017-18, 21% (19,000) of public schools, including charters, offered at least one course entirely online in the US (NCES, n.d.). The figures are same for 2015-16. According to 2015-16 NCES data, 5.7% (around 5,157) schools were offering all courses online (NCES report, 2017). Only in 2013-14, there was more than 10 times increase in the number of fully online (virtual schools) from 478 (NCES, n. d.).

Why Online Education?

We live in an age of knowledge economy that thrives on digital technology and consumes data. Digital technology is ubiquitous and there would hardly be any area that is not affected by the technological advancements. "The digital economy now permeates countless aspects of the world economy, impacting sectors as varied as banking, retail, energy, transportation, education, publishing, media or health" (OECD, 2015, p. 11).

Education is among many sectors benefitting from the proliferation and advancement in technology in terms of access and quality. “Advances in technology, including the Internet, have affected the delivery of education across the world. Online learning is growing at an incredible rate” (Kauffman, 2015, p. 1). Similarly, Eady and Lockyer (2013), highlighting the central position that ICT holds today in education, stating that “Learning with technology has become essential in today’s schools. Worldwide, governments, education systems, researchers, school leaders, teachers and parents consider technology to be a critical part of a child’s education” (p. 2).

Some of the key features as highlighted in the literature are balancing work, school and family life (Kaufmann, 2015); reducing disparities in quality of teaching, and individualized pace (Hart et al., 2019). Similarly, Means et al. (2013) observe that “[o]nline learning has become popular because of its potential for providing more flexible access to content and instruction at any time, from any place” (p. 3). They have mentioned flexibility, cost-effectiveness, and support of qualified instructors as the merits of online education. Parkes et al. (2011) have found that blended education is beneficial for both, the teachers and the learners, as it provides opportunity to the teachers to make up for any teaching loss of time and the online lessons are available 24/7 to the students to benefit from at their convenience. In a nutshell, therefore, online education offers outreach and quality, space independence and time flexibility at much lower costs. Online education is the means to achieve sustainable development goal # 4 that calls for an affordable and inclusive quality education providing access to education to the disabled, sick, and other marginalized groups of the society that face discrimination and restrictions for different reasons.

Last but not least, the recent pandemic (COVID-19) forced businesses to shut down as well as universities and schools. The 'new normal' dictated by the pandemic calls for a switching to online modality. ICT based online education offers a solution to the challenge of the day for uninterrupted education. The colleges and universities in North America, as I noticed, were the first among the educational institutions to adapt and swiftly switch to fully online operation. The K-12 schools are still behind for reasons such as human resource and financial capacity to switch to online modality. It will take time for schools to fully adopt and operate optimally online. The educational time lost is feared to cast its shadow over the quality and quantity of education offered at the school level.

Why This Paper?

Technology is considered to be a strong pedagogical tool that has a potential through wide innovative possibilities to improve quality of teaching and learning thereby resulting in better learning outcomes developing such skills and knowledge base that are relevant to the needs of 21st century and beyond. As Eady and Lockyer (2013) state, "Educators and researchers point to the potential of technology to increase motivation and engagement of learners, cater for different learning styles and improve learning outcomes" (p. 5). One such example, among many other pedagogical approaches, is through meaningful communication between the teacher and learner, learner and learner, and learner and content. This is not only a pedagogical approach for better learning outcomes, but is also a practice to improve communication skills, a basic competency that is required in the practical life in today's shrunk world. "Information and Communication Technologies (ICTs) are transforming the ways social interactions and personal relationships are conducted" (OECD, 2015).

While there is a continued ongoing ICT integration into traditional education at K-12 level, the current pandemic situation is setting a new normal for the global citizens, making online education a more urgent need than a gradual and slow progressing through blending. We already see higher education institutions in North America fully switched to online, adjusting educational needs to the dictates of the situation. Schools can learn from the experiences of the higher education institutions.

There is a myriad of different studies conducted on online education but with very narrow perspectives, such as subject- and technology-specific experimental research, use of instructional technology, practice case studies, etc. As Kirtman (2009) observes, "a considerable portion of the work focussed on barriers to online teaching, advantages and disadvantages of taking or teaching an online class, 'how- to' descriptive articles, and social issues in online courses" (p. 104).

Generally speaking, there is a little research available that would specifically focus on the learning outcomes in online setting; "Much of the research in the area of online teaching and learning has not focused on learning outcomes or academic achievement" (Kirtman, 2009, p. 104). The scarcity is even more noticeable at K-12 level. Most of the available research is at under-graduate and graduate or higher levels. Hart et al. (2019) observes that "a larger body of literature has addressed the relationship between virtual course taking and academic performance in higher education settings" (p. 2). Blohm (2017) noticed that very few studies comparing traditional and online charter schools were available. Similarly, Turley and Graham (2019) have also observed the dearth of literature at K-12 level. "The majority of research on interaction in online learning has been conducted with adult learners at the university level. There is far less literature focusing on

K-12 online learning while investigating interaction, student satisfaction, and teacher time investment" (Turley & Graham, 2019, p. 169). Studying the interaction between students' learning behavior and the class-size in online modality Lin et al. (2018) observe that "no prior studies of the relationship between class size and learning behaviors or outcomes in online K-12 settings appear to have been published" (p. 319).

The literature focussing on the learning outcomes that is available either at K-12 or above, have used differentiated sets of process or condition variables with little overlap. Also, there are other variations in research design, target group/student-type, sample sizes, and confounding variables making any comparisons difficult for having a clear understanding on what should be the set of minimum factors essential for improved learning outcomes in online education.

The paper seeks to identify a set of minimum number of factors most commonly discussed in the literature that have a significant effect on students' learning outcomes in an online setting. Educational institutions imparting online education, as well as the students taking or planning to take online courses can benefit from this study by focusing their resources, efforts and time to the most relevant factors. Especially, given the pandemic situation and keeping in view the schools being behind in the transition from face-to-face to online modality, the findings of this study will inform policy makers and the school administration to develop the infrastructure, online education policies and protocols with these dominant factors in mind to get the best out of online learning.

Definitions

Online Education

While researchers have adopted a variety of working definitions of online education as suited to the research conditions, online education is generally understood as a modality that uses Internet as a means of learning and teaching. Means et al. (2013), for example, in a meta-analysis of 45 different studies, adopted the Sloan Consortium's definition of online learning as learning that takes place entirely or in substantial portion over the Internet. The authors operationalized the concept of 'substantial portion' as at least 25% of the instruction. Similarly, Blohm (2017) defined online schools, as those that deliver their curriculum over the Internet exclusively, providing no in-person interaction between student and teacher.

The term 'virtual school' is used for the schools offering fully online courses with no physical space to be called a school. Or, as Glander (2015) explains,

> A public school that offers only instruction in which students and teachers are separated by time and/or location, and interaction occurs via computers and/or telecommunications technologies. A virtual school generally does not have a physical facility that allows students to attend classes on site. (NCES blog, Para.2)

Learning Outcomes

There is no standard definition of student's learning outcomes. Learning outcome discussion stems from the policy and curriculum debate. Mostly, policies will emphasize the end result seen through the measurable learning goals. Standardized testing is a form of measuring learning outcomes on a given scale range. Citing the literature reviewed, Prøitz and Nordin (2018) state that there is a dominant understanding of learning outcomes as the "end product of education" (p. 646).

The outcomes are discussed with reference to the learning objectives in relation to the theory of change, i.e., what difference the skills and knowledge acquired would make in the life of a student after completion of the course. According to the Centre for Teaching Support and Innovation of University of Toronto, learning outcomes are not merely about the knowledge and skills acquired during a given course, but also about their relevance and ability to apply them in different contexts. The Glossary of Education Reform (n.d.) states that "the term 'student outcomes' typically refers to either (1) the desired learning objectives or standards that schools and teachers want *students* to achieve, or (2) the educational, societal, and life effects that result from *students* being educated" (Para.1). The same source further advises to discuss 'student outcomes' in the background of its contextual definition, as the term may have a general or a 'specific pedagogical or technical meaning' or it may be course-specific.

As mentioned earlier, learning outcomes are mostly seen as the end-product or the results compared to the course objectives measured through tests. To compare the learning outcomes, researchers and practitioners usually use grades achieved by the students at the end of a course, which is considered to be an objective yardstick. However, there are proxy indicators that have also been used by the researchers to measure the learning outcomes. For example, Hart et al. (2019) used three different measures for learning outcomes: 'concurrent course performance' (measured through test scores); 'enrollment and performance in follow-on courses'; and the 'likelihood that a student is observed in the second semester of his or her projected senior year' (p. 5). Packer (2018) used prescriptive and cumulative test scores as well as the report cards to study the difference in outcomes of students taking high school mathematics course. Blohm (2017) measured comparative

learning outcomes for online charter schools and traditional brick-and-mortar schools using the state standardized assessment, Arizona Instrument to Measure Standards (AIMS); while Packer (2018) used mathematics scores of high school students in two modalities to compare the outcomes. Lin et al. (2018) used the end of semester course grades. Some other studies (e.g., Gray, 2016; Borup et al., 2020) used 'students' satisfaction' as a measure of learning outcomes. Ho (2009) used job goal achievement, satisfaction, and skill development as the measure of junior high school students' learning outcomes.

Conclusion

Online education, also called "fifth generation distance education," is increasingly taking over the traditional face-to-face education previously considered superior to the classical distance learning. Fast developing ICT and its increasing use in education has introduced new quality standards with its ever-increasing possibilities in pedagogy. Online learning is receiving more attention from the researchers and policy makers for its outreach, cost-effectiveness, quality of education, and recently for its alignment with the physical distancing.

There are, however, not many comparable research studies available that can be the basis of developing a generalized rule about what works better, and what does not work towards achieving learning outcomes in online education, particularly at K-12 level. Furthermore, while there is observed an increased trend in researching at K-12 level, there is still very little empirical research available. Also, these very few available studies are very limited in their scope. This study explores up-to-date literature to identify the key variables as minimum set of conditions that have significant impact on the online learning outcomes that are also relevant at K-12 level.

CHAPTER 2

METHODOLOGY AND LITERATURE REVIEW

The objective of this literature review is to scan and comb through the up-to-date data available on the online learning outcomes and the factors affecting these outcomes. This chapter is divided into three main sections: i) Research methodology, ii) data collection and analysis, and iii) the results of the literature review.

Research Methodology

In this section, I will discuss the method of systematic literature review and content analysis approach followed.

Systematic Review

Evidence-based decision-making is of prime importance for precise and reliable solutions to any existing problems. “The world is increasingly moving towards evidence-based decision-making due to its proven ability to guide practitioners and policy makers to find out which interventions or methods or programs work effectively, and which don’t” (Khan, 2020, p. 3). I chose to follow systematic review as it is relevant in seeking answer to a specific research question and it is a more organized and transparent approach for gathering quality data for a reliable evidence-based decision making. “Systematic review … is a process of searching, gathering and investigating the literature on a specific topic to identify, select and analyse any evidence of interest” (Khan, 2020, p. 5). Furthermore, this approach is useful in collecting updated information from a wider pool of sources to answer a particular question of interest. “Systematic reviews and meta-analyses can help busy family physicians keep up to date with the medical literature by objectively summarizing

large bodies of evidence in a standardized and concise manner" (Kaczorowski, 2009, p. 1155).

Content Analysis

I used two content analysis approaches in this paper. I began with the conventional content analysis approach with the initial set of data available in order to find out the factors influencing learning outcomes. I followed this approach as there is very little research available on the topic. At the second stage, I followed the directed approach based on the findings of the conventional analysis. This helped me dig deeper into the influencing factors and their interaction with one another.

Data Collection and Analysis

The available literature on the online learning outcomes research, generally speaking, is heterogeneous. At K-12 level, there are not many studies available as compared with the under-graduate and graduate levels. Furthermore, at this level, the scope of studies is very narrow. Overall, there is almost no such study available that can provide a comprehensive, still precise, answer to my research question. Initially, I tried to find more resources from the K-12 level research, because early success in school is foundational for one's life-long learning and higher education achievements. The more we invest as a society at the foundational level, the better results we can expect at higher levels. Furthermore, there is financial and human resources shortage at school level, so it becomes more important for schools to know where to spend and where to save. However, due to scant research available in this area at K-12 level, I tended to keep my selection criteria flexible and broader. This section provides a step-by-step process of data collection, selection and analysis.

Data Collection Technique

In my initial search, I used different keywords and their combinations to get relevant literature. I searched three databases: Google Scholar, ERIC and Omni, using different combinations of the keywords and phrases as filters.

Google Scholar. The following combinations were used to search for the relevant literature:

i) Comparative outcomes in online and face to face education.

ii) ("Learning outcome" OR "Learning quality")
AND ("high" OR "secondary") AND ("school")
AND ("online teaching")
AND Articles dated from 2010-2020.

iii) ("Online education" AND "Learning outcomes")
AND ("high" OR "secondary") AND ("school")
AND Articles dated from 2010-2020.

iv) ("Learning outcome" OR "quality")
AND ("online teaching")
AND ("secondary" OR "high")
AND Articles dated from 2010-2020.

ERIC. The database was searched using the following combination:

i) Comparative outcomes in online and face-to-face education

OMNI. The initial search was made using the following phrase:

i) Learning outcomes and online teaching.

Later, additional keywords such as “learning outcomes and online teaching”; “distance education,” and “comparative learning outcomes,” were used to look for more literature. The first round of search returned 152 hits of which only 9 were found to fit in the selection criteria. Those discarded were either not closely related to the research question (e.g., teachers’ education, specific to a particular subject topic), or were in languages other than English, or were books written on the topic.

Selection Criteria

Inclusion or selection criteria is important in a systematic review for the relevance and authenticity of the data to seek an answer to the research question. “Gathering and reviewing data systematically is called the systematic review whose first step is to identify studies that satisfy the predetermined inclusion criteria” (Khan, 2020, p. 4). I used the following criteria to select articles from the pool of gathered data to include in the literature review:

Subject Matter. The specificity of the research question relates to two major themes i.e., i) the learning outcomes, and ii) online education. In other words, the research question seeks an answer to achieving learning outcomes in an online learning environment. However, I kept the definition of online education quite flexible and included all those papers and other data sources whether studying fully online or partially online courses.

Level (Secondary/High Schools). A third level filter that was applied to the search made it more narrowed by specifying the online education at K-12/secondary level. I included cyber/virtual schools, hybrid education schools, and those offering “a` la` carte” online courses.

Time Period. I focussed on the latest available data to make my work relevant and up to date. I searched for the data from 2010-2020.

Credibility of Source. I prioritized the published sources that were peer reviewed, or published in the reputable journals, or were approved thesis/dissertations of students towards the fulfilment of their degrees.

Language and Geographical Area. Owing to my limitations of languages, I only included the resources published in English. However, I kept the geographical relevance of the researches open and worldwide.

The initial round of search brought a total of 9 articles/papers that followed the above criteria. Of these 9 items, 6 were related to K-12 whereas 3 were mixed (K-12 and post-secondary). It is worth mentioning that 2 of them were literature reviews and 1 was a meta-analysis. These two types covered K-12 and post-secondary levels owing to the focus of study of the available sources consulted by the authors. Please refer below to Table 1 for a complete picture.

Table 1: Articles retrieved in initial search.

Articles	*K-12*	*Mixed*	*Peer Reviewed*	*Dissertation/ Journal*
1. Blohm, 2017	X			ProQuest
2. D-Aduana, 2019	X		X	
3. Hart et al., 2019	X		X	
4. Kauffman, 2015		X	X	
5. Mayer et al., 2017	X		X	
6. Means et al., 2013		X	X	

7. *Nguyen, 2015*		X		MERLOT Journal of Online Learning and Teaching
8. *Packer, 2018*	X			ProQuest
9. *Turley & Graham, 2019*	X		X	

The search for studies that looked specifically at achievement in online high schools yielded limited results (see Table 1). This confirmed statements from the literature by various authors that there exists a deficiency of research which addresses achievement in the online environment for high school students, as referred to in the previous chapter. In the wake of very few articles retrieved in the initial search, I relaxed the selection criteria to include post-secondary studies as well.

Lastly, I applied different keywords used in the earlier searches, such as ("online learning outcome") AND ("moderating variables" OR "class-size" OR "learning behavior" OR "teacher interaction") in order to dig deeper into the frequently studied variables and their relation with the learning outcome. In addition, I used a snowball search either to use in relation to the discussion or to add further from a different perspective. I concluded the search for resources with a collection of 33 articles to use in this research. A list of these articles is given in Table 2 below.

Table 2: Final selection of articles.

Articles by author/s	*Initial search*	*Variable specific, others*	*Snowball search*
1. *Arzt, 2011*		X	
2. *Blohm, 2017*	X		
3. *Borup et al., 2020*		X	

4. Lin et al., 2018		X		
5. Dabbagh, 2007				X
6. D-Aduana et al., 2019				X
7. D-Aduana, 2019	X			
8. Gray, 2016	X			
9. Hart et al., 2019	X			
10. Ho, 2009				X
11. Kauffman, 2015	X			
12. Keramati et al., 2011		X		
13. Kerr, Rynearson, & Kerr, 2006				X
14. Kirtman, 2009		X		
15. Leung & Feung, 2005				X
16. Mayer et al., 2017	X			
17. Means et al., 2013	X			
18. Mupinga et al., 2006				X
19. Nguyen, 2015	X			
20. Oestmann, & Oestmann, 2005				X
21. Öztürk, 2012		X		
22. Packer, 2018	X			
23. Panagiotis and Nikolarea, 2012		X		
24. Park-Stamm et al., 2017		X		
25. Parkes et al., 2011		X		
26. Prøitz & Nordin, 2018		X		
27. Santos et al., 2019		X		
28. Sinclaire, 2014				X

29. Taylor, 2001			X
30. Turley & Graham, 2019	X		
31. Wang, 2017	X		
32. Yi-Cheng et al., 2013	X		
33. Zhang et al., 2018		X	

Coding and Data Analysis

To understand and draw results from the final set of collected data, I implemented a coding system. The high-level codes included i) relevance to education level (K-12 and post-secondary), ii) credibility (peer reviewed) and source type, and iii) thematic focus.

Out of the total of 33 articles, 7 articles were referred for understanding the primary reference context or for the bridging arguments. Among the remaining 26 articles, 14 were K-12 focussed, 3 were mixed i.e., covering K-12 and post-secondary, and 9 of them were post-secondary studies. Table 3 below gives an overview.

Table 3: Articles by levels.

Articles	*Relevance*	
	K-12	Post-secondary
1. Arzt, 2011		X
2. Blohm, 2017	X	
3. Borup et al., 2020	X	
4. Lin et al., 2018	X	
5. Dabbagh, 2007	N.A.	
6. D-Aduana et al., 2019	X	
7. D-Aduana, 2019	X	
8. Gray, 2016		X

9. Hart et al., 2019	X	
10. Ho, 2009	X	
11. Kauffman, 2015	X	X
12. Keramati et al., 2011	X	
13. Kerr, Rynearson, & Kerr, 2006	N.A.	
14. Kirtman, 2009		X
15. Leung & Feung, 2005	N.A.	
16. Mayer et al., 2017	N.A.	
17. Means et al., 2013	X	X
18. Mupinga et al., 2006		X
19. Nguyen, 2015	X	X
20. Oestmann, & Oestmann, 2005	N.A.	
21. Öztürk, 2012	N.A.	
22. Packer, 2018	X	
23. Panagiotis and Nikolarea, 2012	X	
24. Park-Stamm et al., 2017		X
25. Parkes et al., 2011	X	
26. Prøitz & Nordin, 2018	N.A.	
27. Santos et al., 2019	X	
28. Sinclaire, 2014		X
29. Taylor, 2001	N.A.	
30. Turley & Graham, 2019	X	
31. Wang, 2017		X
32. Yi-Cheng et al., 2013		X
33. Zhang et al., 2018		X

Regarding the credibility of the data collected and used, 22 articles were peer reviewed in addition to 3 dissertations/theses available at ProQuest. Table 4 below provides an overview of all the articles.

Table 4: Credibility of data.

	Article	*Source Type*	*Peer Reviewed*	*Source*
1.	*Arzt, 2011*	Report		Non-journal
2.	*Blohm, 2017*	Empirical research		ProQuest
3.	*Borup et al., 2020*	Case study	X	
4.	*Lin et al., 2018*	Empirical research	X	
5.	*Dabbagh, 2007*	Paper	X	
6.	*D-Aduana et al., 2019*	Empirical research	X	
7.	*D-Aduana, 2019*	Empirical research	X	
8.	*Gray, 2016*	Empirical research		ProQuest
9.	*Hart et al., 2019*	Empirical research	X	
10.	*Ho, 2009*	Empirical research	X	
11.	*Kauffman, 2015*	Lit review	X	
12.	*Keramati et al., 2011*	Empirical research	X	
13.	*Kerr, Rynearson, & Kerr, 2006*	Empirical research	X	
14.	*Kirtman, 2009*	Empirical research	X	
15.	*Leung & Feung, 2005*	Empirical research	X	
16.	*Mayer et al., 2017*	Empirical research	X	
17.	*Means et al., 2013*	Meta-analysis of empirical studies	X	
18.	*Mupinga et al., 2006*	Report	X	
19.	*Nguyen, 2015*	Lit review		MERLOT Journal of Online

				Learning and Teaching
20.	*Oestmann & Oestmann, 2005*	Empirical research		Journal of online educators, 2005
21.	*Öztürk, 2012*	Paper		ResearchGate
22.	*Packer, 2018*	Empirical research		ProQuest
23.	*Panagiotis & Nikolarea, 2012*	Empirical research	X	
24.	*Park-Stamm et al., 2017*	Empirical research	X	
25.	*Parkes et al., 2011*	Case study		Computers in New Zealand Schools: Learning, teaching, technology. Vol 23. No. 1.
26.	*Prøitz & Nordin, 2018*		X	
27.	*Santos et al., 2019*	Empirical research		The Turkish Online Journal of Educational Technology.
28.	*Sinclaire, 2014*	Empirical research	X	
29.	*Taylor, 2001*	Article		University of Southern Queensland, Australia
30.	*Turley & Graham, 2019*	Empirical research	X	
31.	*Wang, 2017*	Empirical research	X	
32.	*Yi-Cheng et al., 2013*	Empirical research	X	
33.	*Zhang et al., 2018*	Lit review		ResearchGate

The initial collection of data focussed on studying the comparisons between purely online, hybrid and purely face to face learning outcomes. Browsing of the initial collection identified the following key variables/factors affecting the online learning outcome:

i) Student's learning behavior

ii) Student interaction (with peers, teacher, or course content)

iii) Technology and course design.

These thematic factors were further explored and researched using the directed content analysis approach. Another factor that came up very strongly in some of the researches is the class-size that is observed to moderate some of the above factors, thus indirectly influencing the learning outcomes. Table 5 provides an overview of the themes covered under an overall discussion of the learning outcomes in online education.

Table 5: Main thematic factors affecting online learning outcome.

Articles	*Factors affecting online learning outcomes*			
	Learning Behavior	Student Interaction	Technology Readiness	Class Size
1. Arzt, 2011				X
2. Blohm, 2017				
3. Borup et al., 2020		X		
4. Lin et al., 2018				X
5. Dabbagh, 2007	X	X	X	
6. D-Aduana et al., 2019				
7. D-Aduana, 2019	X			
8. Gray, 2016		X		
9. Hart et al., 2019				

10.	*Ho, 2009*	X			X	
11.	*Kauffman, 2015*	X		X	X	
12.	*Keramati et al., 2011*				X	
13.	*Kerr, Rynearson, & Kerr, 2006*					
14.	*Kirtman, 2009*					
15.	*Leung & Feung, 2005*					
16.	*Mayer et al., 2017*			X	X	
17.	*Means et al., 2013*			X		
18.	*Mupinga et al., 2006*					
19.	*Nguyen, 2015*					
20.	*Oestmann & Oestmann, 2005*					
21.	*Öztürk, 2012*					
22.	*Packer, 2018*			X		
23.	*Panagiotis & Nikolarea, 2012*					
24.	*Park-Stamm et al., 2017*			X		X
25.	*Parkes et al., 2011*					
26.	*Prøitz & Nordin, 2018*					
27.	*Santos et al., 2019*				X	
28.	*Sinclaire, 2014*					
29.	*Taylor, 2001*					
30.	*Turley & Graham, 2019*			X		
31.	*Wang, 2017*	X				
32.	*Yi-Cheng et al., 2013*	X		X	X	
33.	*Zhang et al., 2018*					X

Results of the Systematic Literature Review

There are mixed results and findings of the available studies, some showing better outcomes through online or face-to-face or hybrid learning, and others showing no difference in online and face-to-face education. For example,

> The corpus of 50 effect sizes extracted from 45 studies meeting meta-analysis inclusion criteria was sufficient to demonstrate that in recent applications, purely online learning has been equivalent to face-to-face instruction in effectiveness, and blended approaches have been more effective than instruction offered entirely in face-to-face mode". (Means et al, 2013, p. 35)

A very few studies showed negative results. "Overall, there is strong evidence to suggest that online learning is at least as effective as the traditional format, but the evidence is, by no means, conclusive" (Nguyen, 2015, p. 316).

The comparative studies on online and face-to-face education also bring into discussion the variables studied by these researchers to draw their conclusions. In a technology-integrated classroom and with a technology-embedded pedagogy, especially at the school level, usually technological edge in pedagogy and learning is a thing of general consensus. Despite the immense potential that technology has for innovating and improving quality of education, it is not the technology alone that can result in the better learning outcomes for the students in an online setting. Means et al. (2013) recognize that "different types of factors can affect the size and direction of differences in student learning outcomes when comparing online and face-to-face conditions" (p. 6). Similarly, Ho (2009) points out that the past studies have identified the quality and coverage of content, learner's control, and instructor and group interaction, among other things, as the factors that influence learner satisfaction (a proxy indicator used to measure learning outcomes) with online learning. Technology, therefore, is a quality enhancer with numerous possibilities

for innovation in pedagogy and course delivery. There are some other factors that are considered necessary to achieve learning outcomes. Technology offers tools to expand, proliferate and improve the quality of these factors. Once these factors are there, they impact the outcomes a big way in an online learning environment.

An extensive review of the past literature on this subject reveals these factors and mediators. Most of them are commonly discussed by the researchers. However, there is also a varying degree of heterogeneity present in these research papers which makes it difficult to do between-studies analysis. Some examples are the differences in research methods and sample selection, learning conditions (fully online, a` la cart courses, hybrid), and the set of study variables compared. In other words, the variations in the results have their causal connection with the research frameworks developed that included different sets of variables, and different methodologies used under different conditions. Nguyen (2015) states, "There is strong evidence for the heterogeneous outcomes of the effects of online learning, and in particular, a number of student characteristics such as sex, race/ethnicity, and ability, can moderate the learning outcomes" (p. 314).

In these studies, students' achievements were generally measured either through students' satisfaction or their performance in certain subjects. The qualitative studies have focussed on student satisfaction and their perception whereas the quantitative studies have taken into account students' scores. Using exam scores to study the outcomes by default brings in the subjects of study such as mathematics and language. For example, Blohm (2017), comparing students' achievements in traditional and online charter schools analyzes their standardized test scores in mathematics and English. Mayer et al. (2017) compared students' scores in linear algebra and multi-variable calculus simultaneously

offered to undergraduate students attending Georgia Tech and to high school students who were distributed throughout Georgia. Generally, the selection of school subjects by the researchers is usually part of the convenience sampling depending on the course/subjects picked simultaneously by the students for online learning as well as in face-to-face learning. The qualitative studies relying on subjective scoring based on students' or teachers' perception tend to blur the picture when compared with other similar studies. Likewise, conclusions drawn on a relatively objective basis—test scores—are seen to have limitations because of the range of lenient or stringent marking policy in different schools, or the difference between online courses taken for credit recovery or by full-time online students, for example. Then there are confounds of various types at play. Several researchers have mentioned these. As observed by Blohm (2017), the presence of many confounding variables makes it difficult to compare the achievements of [charter vs. traditional] schools.

It is worth mentioning that the sets of variables chosen by various researchers not only impact their individual findings but also make it challenging to separate crucial from trivial in terms of the individual effects of these variables on the online learning outcomes. There is a little overlap of the set of variables studied. This makes it challenging to develop any standard for comparison between the learning outcomes of the two modalities or to present a prototype for achieving desired outcomes in online learning. As observed by Means et al. (2013), "it is the combination of elements in the treatment conditions, especially the inclusion of different kinds of learning activities that has proved effective across studies" (p. 36).

Suggesting the direction for future research in this area, Nguyen (2015) identifies two paths: 1) "More rigorous research to determine the heterogeneity effects" of online learning by adjusting the process, condition and method variables; or 2) "determine the most efficient and effective learning pathways for different learners in particular courses" (p. 315). While this debate continues and so does the new research, for practical reasons this study explores the latest available literature to extract the critical factors that either directly or through mediators affect the online learning outcomes, or under some conditions, themselves serve as mediators. This study seeks to identify the 'success factors' in online education based on the available resources. In that sense, the study is closer to the second path suggested by Nguyen (2015), thus presenting a set of factors that form minimum and sufficient pre-requisite for a successful online learning experience, or the 'success factors' in online education.

Factors Affecting Learning Outcomes in Online Education

The reviewed literature has discussed several factors affecting online learning outcomes such as learning behavior, learning style, subjects, technology readiness, course design, online collaboration, and interaction. The conditions and types of the studies also vary e.g., there are case studies, empirical researches, meta-analysis, and literature review focussing on secondary and post-secondary online learners taking full course load or a single course. This Major Paper considers those variables that have most frequently been discussed in the reviewed literature and have been echoed in many other papers. These factors have been observed to significantly impact the learning outcomes, directly or indirectly. These variables and moderators collectively relate with all the main stakeholders i.e., school administration, teachers, and learners. The role of parents is presumably implicit

in supporting and facilitating their children in acquiring desired learning behavior, skills and competencies. The factors include students' learning behavior, student interaction, technology readiness and system quality, and class size. These factors are endogenous to the school system and fall under the control of either the school administration (e.g., e-learning system quality and infrastructure), the teachers (e.g., pedagogical approach and course design, content knowledge, teacher interaction); or the learners (e.g., learning behaviour, technology use, collaboration). They have a strong tendency to directly or indirectly impact online learning outcomes. They also interact to create synergy for enhanced learning outcomes. These factors will be described in the latter text.

Blohm (2017) studied comparative learning outcomes of high school students in traditional brick and mortar schools and online charter schools in Arizona, U.S., where she found that traditional schools were performing better than the online charter schools. The study had some limitations such as variations in curriculum standards among states—Arizona Instrument to Measure Standards or AIMS (the state standard) is criterion based, while different requirements exist for charter schools in different states, and no information is available about the socio-economic status of children enrolled. The author did not study any factors influencing the outcomes.

Means et al. (2013), for example, conducted a meta-analysis using 45 studies published from 1996 through 2008 contrasting a fully online or blended learning with the face-to-face instructional condition. The researchers studied a range of practice variables and conditions such as pedagogical approach, means of delivery (synchronous/asynchronous), learners' interaction with each other and instructor, subject

area (e.g., medicine, others) and learner type (e.g., K-12, college, undergraduate, and graduate).

Kauffman (2015) focussed on post-secondary learners to study the learning achievements while considering their emotional intelligence (EI), the attributes of which overlap with those of learning behavior, teacher interaction, cognitive style and technology self-efficacy. Ho (2009), on the other hand, used a small sample (N=376) of junior high school students in Taiwan to study internal and external factors that affect their learning outcomes in online education, and the mutual interaction of these factors. These factors included students' learning behavior, their technology readiness and e-learning system quality.

Darling-Aduana (2019) used school attendance measured by the hours for which students logged into the online sessions compared with physical attendance in face-to-face courses to compare the time spent by these school students during the course to study behavioral change in online course takers. The researcher, however, did not study its correlation with learning outcomes. Turley and Graham (2019) investigated the results of a student end-of-course evaluation survey and teacher communication logs in two online high school courses that were designed with different types and levels of interaction, one with high levels of student-content interaction and the other with high levels of student-content and student-teacher interaction. Gray (2016) conducted a quasi-experimental multiple regression modeling to investigate the ability to predict student satisfaction as an outcome of the frequency and type of instructor interactions along with the demographic factors of age, graduate or undergraduate standing, gender, and final course grade. Lin et al. (2018) studied the class size and subjects as mediators of the learning outcome of high

school students in an online class. The authors also recorded reasons for enrollment in the online class and the gender. The list of factor variables chosen by the researchers goes on.

As evident from the above discussion, there is a spectrum of distinct sets of variables and conditions studied by the authors, for example student type (K-12, college, undergraduate and graduate), setting (fully online, partially online, credit recovery for a single subject), sample size, and yardstick of outcome (final scores, students' satisfaction, completion, etc.).

As the research in this area is progressing, the definitions of studies variables are changing. The working definitions used by the researchers are quite broad and are often seen to overlap with other factors effecting the learning outcomes. For example, learning/academic behavior is seen to include comfortability with technology (which is more a skill than a behavior), or interaction and collaboration between the course participants (which is more related to course design and pedagogical approach), etc. I have tried to regroup these factors of crucial importance by separating skills from behavior, merging some of the characteristic elements based on their similarities and based on the direct control they fall under, such as the learners, teachers, or the school administration. This would also help in focusing the right stakeholder for training and support regarding a particular factor. In other words, this study contributes to the evolution of these working definitions by redistributing the constituent characteristic elements based on their closer relevance.

Students' Learning/Academic Behavior. Multiple studies have emphasized the students' online learning behavior as one of the crucial factors essential for improved learning outcomes at all levels including K-12, college, undergraduate and graduate. This

has come as one of the most emphasized factors in the reviewed literature, significantly affecting the learning outcomes. All these resources have cited several previous studies that showed a strong correlation between learning behavior and learning outcome and have used it as a key influencer of the learning outcomes.

Defining the Learning/Academic Behavior. There is no standard definition of the learning behavior available but there are a number of contextual and working definitions in terms of students' characteristics, traits, skills, and practices, as used by the researchers. For Dabbagh, (2007),

> The emerging online learner can be described as someone who has a strong academic self-concept; is competent in the use of online learning technologies, particularly communication and collaborative technologies; understands, values, and engages in social interaction and collaborative learning; possesses strong interpersonal and communication skills; and is self-directed. (p. 224)

Ho (2009) observes that learning behavior refers to one's response to the challenge in various learning situations. Ho adopted the learning behavior construct used by Leung and Fung (2005). The elements of this construct are,

> coordination (i.e., work with peers, share with peers, get involved, being happy), academic performance (i.e., study confidence, academic goal, active, less distracted), attention (i.e., relaxed, refreshment, concentration, energetic), online preference (i.e., excited in virtual classroom, feel time passes quickly, remain in virtual classroom), discipline (i.e., perform learning activities appropriately and express opinions appropriately and politely), and goal achievement (i.e., creativity, persistence). (Ho, 2009, p. 587)

Means et al. (2013) argue that comparatively blended learning is more effective because of 'more learning time', 'additional instructional resources' and 'interaction among learners'. It is because, "This confounding leaves open the possibility that one or all of these other practice variables, rather than the blending of online and offline media per se, accounts for the particularly positive outcomes for blended learning" (p. 2).

Based on the reviewed literature, Kauffman (2015) concluded that certain learner characteristics and skills are "needed to be successful and satisfied with online learning" (p. 7). These include Emotional Intelligence (EI) i.e., self-awareness of needs, adequate management of feelings; self-regulation; self-discipline; time management; organisation; planning; self-evaluating; reflective/visual learning styles; and internal locus of control. Kauffman states that the lack of success in online learning is related to having lower EI. Kauffman also highlighted the important role of "self-regulation (including time management skills, active learning style and self-discipline) and motivation" (p. 7) in online learning. Apparently, "poor time management and lack of motivation [are found in some studies] as significant underlying barriers in the learning outcomes" (p. 7).

Darling-Aduana (2019) studied time spent by learners in online learning and found that "Academic behaviors such as attendance are highly associated with academic outcomes" (p. 1). Other characteristics discussed by the author under academic behavior are students' self-efficacy, persistence, self-regulation, and internal control in an online setting. That is related to students making choices in how much time they will dedicate to studies. For Darling-Aduana, "[b]ehavioral engagement, including attendance and out-of-school learning, is a critical mediator to achievement, particularly in an online course setting where students, versus teachers, dictate how much time students spend logged in and engaged in learning-related activities" (p. 2). Additionally, Darling-Aduana, Good, and Heinrich (2019) have studied 'help-seeking by students' as part of their academic behavior. This element is discussed under 'student-interaction' in the next pages.

Findings in Brief. Based on data from 10 urban junior high schools in Taiwan (N=376)**,** Ho (2009) concluded that the learning behavior directly impacts learning

outcomes. The effect of learning behavior on learning outcome was observed to be stronger under the influence of e-learning system quality, as well as technology readiness. The author further noticed that technology readiness and e-learning system quality indirectly effect the learning outcomes through the students' learning behavior. In other words, technology readiness and e-learning system quality directly affect the student's learning behavior, which in turn, results in better learning outcome.

Means et al. (2013) conducted a meta-analysis of 45 studies analyzing the effect sizes of different variables on learning outcomes showed that purely online learning has been equivalent to face-to-face instruction in effectiveness, and that blended approaches have been more effective than instruction offered entirely face-to-face. The types of learners in the studies in the meta-analysis were about evenly split between students at college or at earlier years of education and learners in graduate programs or professional training. The authors argue that blended learning modality tended to involve more learning time, additional instructional resources and course elements that encourage interactions among learners.

Kauffman (2015) conducted a literature review to explore the factors affecting learning outcomes and students' satisfaction in online education. The author presents the "profile of a successful online student" based on the synthesis of reviewed literature as "one who demonstrates greater EI, that is, self-awareness of needs, adequate management of feelings, self-regulation skills, self-discipline, time management, organisation, planning, self-evaluating, reflective/visual learning styles, and internal locus of control" (p. 7).

Darling-Aduana (2019) used 'attendance' as a measure of learning behavior, finding that "Estimates capture an important precondition to learning—school attendance

and online sessions logged" (p. 9). The author conducted a study using six years of longitudinal data from a large, urban school district that enrolled students in online courses primarily for credit recovery. The researcher concluded that the students completed their online course in fewer class periods than required to complete a comparable course in a traditional, face-to-face instructional setting.

Student Interaction. The classical concept of didactic teacher-centered education with a 'subject-object relation between the teacher and student' i.e., 'banking education' as Paulo Freire (1970, p. 72) called it, has evolved through 'active learning' to a more interactive 'collaborative learning' in the traditional face-to-face setting. This process resulted in the learners having comparatively (though not absolutely) more freedom to form groups in which they can learn and create knowledge. These epistemological ideas have influenced distance education alike. Development in ICT has revolutionized communication, collaboration, and knowledge sharing. Dabbagh (2007) argues that,

> The concept of the independent, place-bound, adult, self-motivated, disciplined, self-starter, and goal-oriented learner, which largely characterized the classic distance education learner, is now being challenged with socially mediated online learning activities that de-emphasize independent learning and emphasize social interaction and collaboration. (p. 219).

Dabbagh described a successful online learner as one who "understands, values, and engages in social interaction and collaborative learning; possesses strong interpersonal and communication skills" (p. 224).

Researchers have mentioned three types of interactions that an online (as well as face-to-face) learner experiences - interaction with teacher, with fellow students, and with content. That means a learner can learn from all these three sources, and not only the teacher as in 'banking education'. Turley and Graham (2019) state that the "positive

influence of interaction in online learning has been documented by educational researchers in both postsecondary and K-12 settings" (p. 172). The authors observed that a few studies focussing on college students showed a "correlation when student-content, student-student or student-teacher interaction goes up, and so does student satisfaction" (p. 170).

Kauffman (2015) found that the learners showed satisfaction with the online courses that were "structured, interactive, i.e., constructivist instructional design, relevant, i.e., application based with practical significance, and instructor facilitated in terms of interactions/feedback" (p. 8). The author states that the courses that facilitated increased performance and satisfaction were interactive and allowed for collaboration among students.

Student-teacher interaction is considered as a crucial factor in the higher student satisfaction and learning outcomes. In online modality, there is an increased emphasis on it because of the spatial and, in case of asynchronous learning, temporal distance between the teacher and learners. According to Blohm (2017), "[a]nother characteristic of online learning that students and professors must overcome is the physical distance between them" (p. 32).

Gray (2016), based on literature review, observes that the student-teacher interaction is significantly important in online learning. This type of "interaction has been identified as a valuable component in online education because of the isolation of both instructors and students" (p. 93). She further concludes that the students' satisfaction is a function of instructor's feedback. "The amount of instructor feedback given significantly predicted satisfaction such that a lack of feedback was related to lower satisfaction" (Gray, 2016, p. 85).

A quasi-experimental regression modelling study conducted by Gray (2016) shows a strong correlation between quality and quantity of student-teacher interaction and student satisfaction. “Student satisfaction can be predicted based on the type and frequency of teacher behaviors associated with teacher presence in the online classroom” (Gray, 2016, p. 89). Furthermore, timeliness of instructor feedback (swift response) was observed as another element of higher satisfaction.

Turley and Graham (2019) conducted a case-study to explore difference in satisfaction of learners between two online course models with high and low student-teacher interaction in mathematics and English. The authors used Terry Anderson’s (2003) Interaction Equivalency Theorem as the theoretical framework. Turley and Graham (2019) explain the theorem as “learning effectiveness will be achieved as long as an instructional designer designs the course with at least one of the three types of interactions (student–teacher; student-student; student-content) at a high level. Other forms of interaction may be included at lower levels or excluded altogether, and not affect the quality of learning” (p. 174). The authors compared two course design models: One with a high level of student-content interaction and a low level of student-teacher interaction, whereas the second one with high levels of student-content and student-teacher interaction, but a low level of student-student interaction Quality and quantity of student-teacher interaction were observed to be of higher value. The authors found that students were more satisfied, on average with timely instructor response, meaningful instructor feedback, and instructor rating thus concluding student-teacher interaction as a crucial contributor towards students’ satisfaction, an indicator of the student learning achievements. “Most participants in this study reported acceptable levels of student satisfaction but experienced a general increase

in satisfaction in areas in a course with higher levels of interaction" (Turley & Graham, 2019, p. 191). The authors found these results in line with other studies showing higher completion rates with increased student-teacher interaction. Parks-Stamm et al. (2017) noticed that "students perceive the role of the instructor as a facilitator of discussion to be particularly important for online courses and they find instructor-moderated discussions more appealing" (p. 1251). Means et al. (2013) in their meta-analysis observed a significantly positive mean effect size for collaborative and expository instructional approaches. As explained by Means et al. (2013, p. 8), the collaborative or interactive learning activity, in which the learning takes place through learner-learner, learner-teacher or learner-content interaction. The expository instruction is that in which content is "instructor- or computer directed" and can be a piece of text, a lecture by the teacher, or an "instructor-directed discussion". In other words, these findings also support the argument that any of the three kinds of interaction (student-student, student-teacher, student-content) has a positive effect on learning outcome. Similar conclusion has been drawn by Yi-Cheng et al. (2013). According to them, "the interactions among students, between faculty and students and learning collaboration are the keys to learning process effectiveness" (p. 1331).

Student-student interaction or peer interaction is learning with peers. Collaboration, that is generally considered a learning behavior function, is a form of peer interaction where students jointly work on a project, problem or knowledge creation. Peer interaction is also known to develop certain learning behaviors necessary for student-led and student-centered learning. Borup et al. (2020) conducted a study about students' perceptions of their interactions with their peers at a cyber charter high school. They observed that a "majority

of students believed that interactions with their peers were beneficial because their peers could engage in instructing, befriending, collaborating, and motivating support" (p. 217). Already, Kauffman (2015) has found the "constructivist" course design being a source of satisfaction for online learners, among other factors.

Student-content interaction is about learner's engagement with course contents which may be a web-based piece of information, online lectures and videos, presentations, or an e-book. While a learner benefits with the other two types of interaction through a two-way communication, the interaction with content is one-way, unless it is an interactive web-based program that can give feedback in terms of right or wrong answers, for example. Researchers have highlighted the importance of interactive lesson designs where students can access various information through hyperlinks inserted. The authors justifying better outcomes in blended learning argue that the students spend more time with the learning material (Means et al., 2013). The more time spent with instructional material means a higher-level student-content interaction that is also effective in purely online learning, as Terry Anderson's (2003) Interaction Equivalency Theorem implies. The same argument is also confirmed by Darling-Aduana's (2019) in her study on the time spent by online students on class attendance and participation in the learning activities. Generally speaking, students with more self-regulation, organizations and planning, and having an independent learning style demonstrate high level of student-content interaction. This increased engagement of students, as defined earlier, reflect their positive learning behavior.

Technological Readiness (Students' Prior Skills in Using Technology). Technology has opened up new avenues for progress in different fields and education is not an exception. ICT with its enormous potential brings a wealth of opportunities for

knowledge seekers. In Siemens' (2004) view, "Informal learning is a significant aspect of our learning experience. Formal education no longer comprises the majority of our learning. Learning now occurs in a variety of ways – through communities of practice, personal networks, and through completion of work-related tasks" (p. 1). Access to information, knowledge, knowledgeable people and similar sources are all a click away, thanks to the ICT revolution. It has made it possible for the formal education system to embrace infinite informal learning opportunities thus exponentially increasing access to knowledge sources as well as the possibilities of knowledge creation. ICT connects a remote school and students in a far-off location to those in modern cities making quality education equally accessible for all. Groff (2013) puts it succinctly when stating that "ICT now brings access to educational materials and experiences of a richness and kind that previously would not have been possible, or accessible only in discrete locations (such as a university library)" (p. 16).

However, in order to benefit from these vast learning opportunities, one needs to be literate in the use of technology and relevant tools, just like a novice school goer, for whom reading, writing and numeracy are the basic skills to learn at first before s/he can benefit from the printed and written sources of knowledge. For Mupinga et al. (2006), "[s]uccessful online students are expected to have access to necessary hardware and software, and to be minimally proficient in using the technology" (p. 1). Similarly, Dabbagh (2007) expects a successful online learner to be "competent in the use of online learning technologies, particularly communication and collaborative technologies" (p. 224). Several other authors have emphasized the need of learning ICT skills. According to Keramati et al. (2011), "[s]tudents should be familiar with computer skills to be successful

in this [e-learning] system" (p. 1921). The authors studied students' "motivation, attitude and computer self-efficacy" (p. 1921) to measure student factor's effect on learning outcomes. Panagiotis and Nikolarea (2012) suggest that "pupils' contact with ICT should also ensure that they acquire the desired digital literacy in addition to traditional literacies (i.e., linguistic and numerical)" (p. 21).

Literature shows varied expectations from a digitally literate person, hence different working definitions. For example, Panagiotis and Nikolarea (2012), propose to include personal attitudes toward ICT, i.e., using it "effectively and without phobic hang-ups." According to them, digital literacy includes skills in "searching, assessing, organising and using (digital) information" (p. 22). Media Smarts (a Canadian not-for-profit charitable organization for digital and media literacy) classifies competencies for digital literacy according to three main principles: use, understand and create. Santos et al. (2019, p. 19), on the other hand, observe that "some of the recent literature studies on literacy in ICT show that this should incorporate Internet literacy, Computer literacy and Information literacy".

Educators' and learners' skills in Web 2.0 technology tools are fundamental for quality learning outcomes in a fully online course. Groff (2013) defines "Web 2.0 technologies—a collective term for the—social web representing the online tools that facilitate collaboration, communication, and interactivity" (p. 5). In a study focussing on the Grade 7–12 students in Brazil, Santos et al. (2019) concluded that "ICT literacy is a determining factor in school performance of students of the 3rd cycle of basic education and secondary education" (p. 34). Ho (2009) found that "the self-perceived technology

readiness of junior high school students positively affects their online learning behaviors" (p. 593).

As traditional learning tools are phasing out with more and more educational activities designed around technology, where the schools can be in integration phase, practising hybrid learning or completely online, for students to have skills in the use of ICT takes the fundamental place in their pursuit of education and later lifelong learning. Also, with the continuously evolving technology and the development of newer technological tools, there cannot be a prescribed curriculum for ICT-related skills for online learners. Arzt (2011) observes that "as the technology evolves and as both students and instructors become more technologically savvy—including students at a younger and younger age adapting to working online—and more and more courses are offered online, the complexion of online learning in the future is a moving target" (p. 13).

Class Size. In traditional, face-to-face education, class size is an important indicator of quality education. The UNESCO Institute of Statistics considers pupil-trained teacher ratio as a key resource or input indicator that contributes to the overall quality of education. A trained teacher can use his/her skills better in a class of manageable size. Therefore, the pupil to trained teacher ratio is considered an important determinant of learning outcomes and an indicator of the overall quality of education system (see http://uis.unesco.org/node/3297546). There is a plethora of literature available supporting benefits of a small class size in face-to-face learning (e.g., Lin et al., 2018).

With the advancement in technology, distances have become irrelevant. ICT has exponentially increased outreach and easy access to quality education thus opening up opportunities, for those otherwise excluded and hard-to-reach learners, through online

provision of education. However, “such goals appear to be associated with extreme class sizes” (Lin et al., 2018, p. 318). Miron and Gulosino (2016) report considerable outliers in NCES raw data for 2013-14 on teacher-student ratio in virtual schools, ranging from 1.3 to 356. How the extreme class sizes impact learning outcomes in a virtual learning environment is unknown, because there are “no prior studies of the relationship between class size and learning behaviors or outcomes in online K-12 settings appear to have been published” (Lin et al., 2018, p. 319). Most of the prior studies have looked into its “relationship with some other factor(s) essential to online learning” (Zhang et al., 2018, p. 273), suggesting an ideal class-size. Zhang et al. observed “mixed findings and no strong consensus” (p. 273) regarding this issue, with some scholars favouring small class size and others considering it irrelevant. Kirtman (2009) notes that “[s]ome faculty perceive that while teaching online may increase enrollment and interest in the program, it does so at the risk of decreasing student learning” (p. 103).

According to Arzt (2011), “although a review of the literature [post-secondary] suggests class sizes between 12 and 21 are appropriate, the research also shows that a variety of variables besides class size affects student learning as well as student and instructor satisfaction with a course” (p. 2). Arzt (2011) conducted a literature review to investigate class size in online setting at post-secondary levels. The author proposed a class-size between 15 and 22 for undergraduate programs “assuming a degree of healthy interactions among students, with the instructor, and with the very content”, a class-size on 15 at graduate level “to facilitate in-depth discussion and some degree of instructor-to-student mentoring and professional counseling” (p. 12).

Parks-Stamm et al. (2017) studied a large sample of 7,477 students enrolled in under-graduate and graduate courses in education, business, social sciences, nursing, language, and mathematics, among others, and the class-sizes ranging from 2 to 30. The dataset included weekly discussion forum participation frequency, including 414,645 student posts and 59,386 instructor posts. The results showed that the class size is a moderator of the relationship between instructor and student participation. In small classes (less than 15 students), instructor participation increases student participation. In medium classes (15–30), on the other hand, instructor participation does not impact student participation.

Lin et al. (2018) suggest that extreme online class sizes, in either direction, are likely to have negative impacts on students' learning outcomes. The authors studied a large sample of 12,032 high school students taking courses in algebra, geometry, and beginning Chinese at a virtual school offering a self-paced and asynchronous supplementary program of 'a` la carte' online courses. Using a hierarchical linear modeling with fractional polynomial analysis the authors observed a reverse-U-shaped relationship between class size and overall learning outcome. The achievement level increased with the class size to a certain number and then dropped beyond that number of class size. They concluded that increasing online class size had a "positive impact on achievement until the number of students reached 45, but a negative one if numbers increased beyond that level" (p. 326). At the subject level, they observed a similar pattern for mathematics, social science, and other subjects (e.g., arts). The authors noticed that "In English, foreign languages, and science, however, the impact of class size on learning outcomes was non-significant" (p. 332).

Lin et al. (2018) further state that "it is also worth noting that the optimal class sizes for self-paced courses reported in this study (i.e., 38 in math, 42 in social science, and 35 in other non-language subjects) are much higher than the average sizes of face-to-face high-school classes (i.e., 24.2: see Coopersmith 2009)" (p. 331). Arzt (2011) observes that the amount of time students are willing to devote to their studies will also affect the class size. This has backward connection with the learning style i.e., independent or collaborative. According to Haynie (2014), experts give importance to class size in synchronous learning, while they are divided on the proper sizes of asynchronous classes.

Conclusion

A large body of literature from 2010-2020 and older has acknowledged online education as equally good if not better than the traditional face-to-face education in terms of the learning outcomes. Researchers studying hybrid/blended learning have found it even better for various reasons. The discussion on comparative learning outcome quality has brought to light certain elements or factors which significantly affect the online or hybrid learning outcomes and have commonly been discussed by the researchers. These include student's learning behavior, more time devoted to learning, student-content, student-teacher and student-student interaction, as well as the use of ICT. All or some of the factors are missing in the traditional face-to-face learning that makes it comparatively poor in overall learning outcomes.

CHAPTER 3

DISCUSSION AND CONCLUSIONS

Use of technology enhances learning experience. Online education that is solely conducted through the use of ICT has a great potential to take the quality of education to new heights and enhance the learning experience making it meaningful, relevant and precise by many times. We have observed that the online learning has some gaps when compared with face-to-face learning, such as level and quality of interaction, mentoring and support of the teacher. We also see from the literature that ICT has a great potential not only to bridge these gaps but also to improve upon them in an online environment.

In the previous chapter, we observed certain high-impact factors which, if harnessed in an online modality, could result in better learning outcomes than in face-to-face. These high-impact factors are the minimum necessary elements for a successful online learning experience. We can also call them the ‘success factors in online learning’.

These ‘success factors’ are not standalone but interact with one another in given conditions to reinforce or undermine the overall effect. In this chapter, I will discuss these factors with respect to their individual as well as combined effect based on the literature review, to understand the online learning environment dynamics and to develop a picture of an ideal online learning environment vis-à-vis the role and responsibilities of the key stakeholders in the learning process.

Learning Behavior

In the previous chapter, student’s learning/academic behavior has stood out as a condition for success in online learning. The main elements of learning behavior

highlighted in various studies include self-directed (Dabbagh, 2007); coordination, academic performance (i.e., study confidence, academic goal, active, less distracted), attention, online preference, discipline, and goal achievement (i.e., creativity, persistence) (Ho, 2009); self-awareness of needs, adequate management of feelings, self-regulation, self-discipline, time management, organisation, planning, self-evaluating, reflective/visual learning styles, internal locus of control, motivation (Kauffman, 2015); time spent on learning (Darling-Aduana, 2019; Means et al., 2013). While the list seems to be long, on a closer look we notice that some of the elements could be merged based on the similarity of the actions required (e.g., academic performance and goal achievement or of their results; self-regulation, self-discipline and internal locus of control). Furthermore, some of the elements are the skills such as management of feelings, self-regulation, self-discipline, time management, organisation, planning, self-evaluating, that are required to demonstrate certain other characteristics (e.g., time spent on learning, attention, and online preference).

Student Interaction

As observed in the literature, student interaction has three dimensions: Student-teacher, student-student or peer interaction, and student-content interaction. Researchers have concluded that each of these three types of interactions has a positive impact on the learning outcome in online environment; the degree of impact may vary owing to the research conditions, set of variables chosen, and the presence of possible confounds. Interactive and collaborative learning is replacing independent learning (Dabbagh, 2007) as a more effective and more suited to the technology-supported learning. According to Ho (2009), “a number of researchers find interactivity to be one of the most important functions of computer-mediated learning” (p. 583). Researchers have also observed that

students are more satisfied with online learning that involves intense student-content, student-student or student-teacher interaction (e.g., Turley & Graham, 2019; Darling-Aduana, 2019; Gray, 2016; Mayer et al., 2017; Kauffman, 2015; Yi-Cheng et al., 2013). Means et al. (2013) noticed significant effect of both collaborative and expository learning on learning outcome.

Researchers have emphasized the importance of student-teacher interaction to counteract the physical distance and isolation between the two in the online context (e.g., Gray, 2016; Blohm, 2017). Parks-Stamm et al. (2017) highlight the importance of instructor-moderated and facilitated discussions more satisfying for the students. Some researchers (e.g., Gray, 2016; Turley & Graham, 2019) have studied the type and frequency of such interactions and found a positive correlation of these with students' satisfaction. Student-content interaction is also highlighted to contribute positively to students' satisfaction. Means et al. (2013) and Darling-Aduana (2019) have mentioned this interaction in terms of time spent by online learners with the instructional material and learning activities. An interesting observation, however, a unique case, by Darling-Aduana et al. (2019) was that the learners with high level of self-efficacy, sufficient self-regulation skills, including focus and persistence may engage in lesser degree of student-teacher and student-student interaction and a higher degree of student-content interaction. Studying the type of interactions occurring between teachers, students, and educational technology among a group of online credit recovery high school students gathered in a computer lab with a teacher physically present to help upon request, an atypical observation by the researchers was of a student who "possessed sufficient self-regulation skills, including focus and persistence, that she maintained productive interactions with the software

interface. Furthermore, she appeared to possess requisite academic skills, such as minimum reading proficiency and study skills, further facilitating access to course content" (Darling-Aduana et al., 2019, p. 11).

Technological Readiness

Technological readiness or student's prior skills in using ICT for educational purpose cannot be overemphasized in an online learning environment. In online education, ICT is the medium for educational activities and that makes its role pivotal. Teacher designs the course using appropriate technology tools and platforms that support different pedagogical activities, styles and approaches. A prospective online learner is expected to have the required level of ICT skills. In other words, it is one of the basic requirements in an online education for both the educator and the learner to establish certain level of communication conducive for meaningful learning. An online learner should be able to navigate through the course work such as searching the Web, accessing the resources shared by teacher and peers, preparing Power Point Presentations, using word processing or spreadsheet apps for their assigned tasks, collaborating and file sharing using the Web-based interactive and document sharing tools, etc. Several studies emphasize the need for ICT literacy (e.g., Keramati et al., 2011; Mupinga et al., 2006; Panagiotis & Nikolarea, 2012; Santos et al., 2019) for the students to be successful in technology-supported online education. For Santos et al. (2019) , online learners need not only to be proficient in the use of various tech-tools but should also be able to use their technological skills critically and competently, which is similar to Eady and Lockyer's (2013) "meaningful development of technology based knowledge and skills" for students in order to avoid "second level digital divide" (p. 5). While it is commonly agreed that the younger generation is in habit

and is more comfortable with using technology such as smart phones, social networking, digital games, etc. however, using the technology for meaningful learning for targeted objectives is more than merely using the common tech-tools. “It is also important to help students make the transition from using technology to learning with technology” (Packer, 2018, p. 78).

Teachers can help learners coming with different background technological knowledge and skills to develop their skills to the required level. Principals and teachers should “accommodate the needs of students with different levels of technology readiness” (Ho, 2009, p. 595). Students, having inclination towards technology use and with the help of peers, teachers and parents can be able to develop the relevant skills that facilitate online learning. Kerr, Rynearson, and Kerr (2006) observed that,

> first-time online students often report that they have low technology skills and/or have anxiety associated with the use of technology. However, the novice students quickly develop requisite computer skills and perform well in the course as long as they possess other qualities such as high self-esteem, reading and writing proficiency, and independent learning. (p. 102)

The more tech-savvy students are, their quality and quantity of learning would improve too. “As students develop greater comfort with the online setting, their performance could easily change” (Hart et al., 2019, p. 15). As discussed in the previous section, learner’s self-efficacy has a positive impact on their learning behavior that in turn gives better learning outcomes.

Studies (e.g., Arzt, 2011; Santos et al., 2019) have also emphasized the need for learning new technologies as there is a continuous innovation and development happening in this field. “It is important to know not only new technologies, but also to master them

and to realize that they are constantly changing" (Santos et al., 2019, p. 19). Kaufmann (2015) observed mixed findings about technological skills and success in online learning.

Class Size

Unlike in face-to-face learning, class size in online learning is a topic rising mixed opinions. Class size is among the critical factor in online learning, and therefore has been a subject of study by several researchers. Some researchers have advocated for small class size whereas some others consider it irrelevant. Also, there are wide extremes in class sizes as observed by different researchers. Almost all these observations are from the post-secondary education, including under-graduate and graduate classes and, unfortunately, there is a little literature available at K-12 level.

Despite various ideal class sizes proposed by researchers, a general observation is that the class size impacts learning outcomes by interfering with student-teacher and student-student interaction thus affecting student's learning behavior. Lin et al. (2018) have cited several studies favoring small class size in face-to-face setting for a variety of reasons (e.g., better student-teacher interaction, better learning behavior, and better outcomes). Almost similar reasons have been forwarded by researchers favoring small class size in online education. Furthermore, class size and outcome relationship vary with other factors such as synchronous/asynchronous studies, subject, learning style, pedagogical approach, and teacher's capacity, as previous literature shows (see Zhang et al., 2018). Lin et al. (2018) and Zhang et al. (2018) have observed that the online class-size interacts with other elements of online learning therefore, contextual factors should be considered to draw any results.

Zhang et al. (2018) classify the approaches to determining optimal online class size into four categories as observed from the previous literature: From teacher's perspective ("to adjust the class size to suit teachers' workloads, levels of teaching experience, and pedagogical approaches"); from learners' perspective ("the ideal class size based on students' learning performance"); from student interaction ("ideal class size based on the quantity of online learning interactions"); and from the subject angle ("online class size must be tailored to each academic subject") (p. 276). Arzt's (2011) literature review supports medium class size (between 15 and 22) at post-secondary level for better student-student, student-teacher, and student-content interaction. Parks-Stamm et al. (2017) concluded that the class size is a moderator of the relationship between instructor and student participation. Lin et al. (2018) studying the relationship between online class size and learning outcome for large sample of high school learners observed that extremely small size and extremely large size have adverse effects on the learning outcomes. They found that the learning outcomes rise with the class size and are at maximum at 45, after which the outcomes start declining.

Zhang et al. (2018) observe that there is not enough evidence available to determine the optimal online class size at K-12 level. "Without a large new pool of K-12 data, it will continue to be difficult for researchers to arrive at a clear understanding of the status quo, without which, recommendations for changes in class size will be broadly meaningless" (p. 278). The authors further recommend conducting more studies on the effect of class size on learners' learning behavior.

Discussion

Almost all of the elements discussed under first two factors i.e., learning behavior and student interaction are equally relevant in online as well as face-to-face learning. However, some factors are prominently present either in online or face-to-face modality because of the very nature of the environment. For example, student-teacher interaction is at a higher level in the traditional classroom because of the physical presence of both in a particular space-time. The student-student interaction is also high, but its scale and quality may be different in an online environment. On the other hand, online environment provides a vast access to learning resources while the content available in a face-to-face class is less diverse and offers a limited view of the topic (I am assuming the face-to-face class without ICT utilization).

Most of the elements of learning/academic behavior (e.g., time spent, attention, interest, self-regulation and motivation) are required in both face-to-face as well as in online learning. Leung and Fung (2005) studied learning behavior as a mediator between school facility management (infrastructure improvement) and student's learning outcome in face-to-face learning. In a face-to-face environment, many elements of the required learning behavior such as time management, organisation, planning, and evaluating are managed or at least facilitated by the teacher and the school administration. The school timetable would take care of how much time to be given to each subject, how to plan and organize teaching-learning activity and evaluate the needs and competency level of the learners - all covered in the school routine. Learner's attention, interest and motivation are easily observed in a face-to-face setting by the teacher who can facilitate by adopting appropriate classroom strategies and switching between the pedagogical techniques. In that

sense, traditional 'brick and mortar' school offers a complete package of academic, behavioral and organizational support to the students.

The nature of learning environment in a face-to-face classroom is such that it facilitates a synchronous two-way communication through observation of visual cues and gestures in addition to verbal communication. In an online modality, even if it is a synchronous session, teacher receives no such observational feedback from the students who are logged in from their homes. As Blohm (2017) comments, "Much of the interaction between professor and student is lost when using an online or internet format. The internet format can leave students and professors feeling disconnected" (p. 32).

To conclude, in an online modality, particularly when it is organized as self-paced and asynchronous learning, much of the responsibility is shifted to the students. According to Kauffman (2015) "[t]he student is responsible for reviewing course material, taking exams at scheduled intervals etc., which requires adequate self-regulation skills" (p. 7). All online students do not demonstrate all the characteristics of the required learning behavior. There are different combinations of characteristics with varying degree. As observed by (Kaufmann, 2015), "[s]tudents may vary on learning styles, cognitive styles, self-efficacy, persistence, self-regulation, affective skills, etc." (p. 2). Blohm (2017) has also shared the view that some learners may lack the perseverance and responsibility as demanded in online education. To develop and strengthen the required characteristics and skills, a learner would need practice that itself requires hard work, persistence, and self-control. In other words, a learner has to be self-disciplined to persistently build required skills through continuous practice which, in turn, strengthens self-discipline and self-regulation. These characteristics and skills are mutually supporting and feeding each other (e.g., once the

practice shows results, confidence builds up in the use of the practice). As in the case of technology, a 'study confident' learner would feel more engaged and in control of the system, to use it towards achieving learning goals. Kauffman (2015) further observes that "perhaps students enter the world of online learning equipped with requisite skills for using the technology, and because of the high level of self-regulation skills they possess, they become self-motivated to learn how to navigate through the course" (p. 8).

Teacher can play a crucial role in helping the online learners acquire these skills and characteristics that comprise a conducive learning behavior. As observed by Blohm (2017) high school learners in a virtual environment "may be less autonomous or independent than post-secondary students" and lacking an internal motivation to demonstrate the required learning behavior. The author further suggests online teachers to "captivate and motivate their students" (p. 32).

This brings us to the second factor—student interaction with teacher. In an online course, teacher can help by knowing the students' learning gaps and can design the course with a higher level of student-teacher interaction to make his/her presence more felt and facilitate for the novice online learner who lacks certain behavioral traits. Researchers (e.g., Dabbagh, 2007; Kauffman 2015) have suggested that knowing the characteristics and needs of an online learner would help teacher decide which factors could contribute to a successful learning experience and which could be detrimental, and thus accordingly adopt the best pedagogical approach. Kauffman (2015) further adds that "adequate instructional methods, support, course structure and design can facilitate student performance and satisfaction" (p. 1). Wang (2017) has supported such a course design that invokes learner's behavior and emotional and cognitive engagement together with encouraging learner's

self-reflection and self-assessment. In that context, the mediating role of e-learning system quality, as studied by Ho (2009), cannot be ignored. Ho concluded her study by suggesting "that junior high school principals and teachers can improve their students' learning outcome via e-learning by facilitating proper learning behaviors, such as promoting better interaction between peers and helping students remain focused on online activities" (p. 595).

Student-teacher interaction, apart from behavioral support, also includes academic guidance. Turley and Graham (2019) noticed that "timely instructor response time, meaningful instructor feedback, and instructor rating" (p. 187), were most highly valued by the students. Parks-Stamm et al. (2017) noticed that "students perceive the role of the instructor as a facilitator of discussion to be particularly important for online courses and they find instructor-moderated discussions more appealing" (p. 1251).

It is, however, observed by some researchers that the teacher should have good content knowledge for a meaningful student-teacher interaction. With a teacher having inadequate content knowledge, student may not find it useful to interact. Darling-Aduana et al. (2019) observe that "it is possible that many students might decide there is little value in requesting instructor assistance" (p. 19). The authors also noted that the "ratings of instructor-student-digital tool interactions were also significantly lower in classrooms with a substitute teacher" (p. 25).

The resources of learning are not limited to teacher or the textbooks. Students themselves are a vast source of knowledge. Like jigsaw pieces, peers work and think together using these bits and pieces of information to arrive at the solution. "Vygotsky's Socio-Cultural Cognitive Theory and subsequent research supportive of the theory

indicated that increased social interaction among students also increases cognitive development" (Oestmanns, 2005, p. 2). Means et al. (2013) observe that "one common conjecture among the researchers on technology is that learning a complex body of knowledge effectively requires a community of learners,…promoting 'participatory' models of education" (p. 4). Thus, a course designed with increased student-student collaboration creates a learning environment where students interact with one another and with the group to find solutions to the problems in problem-based learning. As mentioned by Wang (2017), online learning activities based on problem-solving that encourage student-content and student-student interaction are central to effective learning.

> In application of Vygotsky's theory, online educational institutions have focused the majority of content delivery systems utilizing discussion threads as a modality to create an atmosphere where students have maximal interaction with other students and instructors in order to optimize learning outcomes and cognitive development. (Oestmanns, 2005, p. 2)

Student-student interaction also helps online learner build necessary skills such as coordination, collaboration, planning, and being goal oriented. Mayer et al. (2017) observed that group work activities develop social cohesion among learners and positively impact student satisfaction which supported earlier literature. Online learning provides an enabling and developing environment where students learn from each other, get social as well as academic support, constructive feedback, and motivation to learn new skills and construct knowledge. Yi-Cheng et al. (2013) observe that "a positive learning climate encourages and stimulates the exchange of ideas, opinion, information, and knowledge in the organization that will lead to better learning satisfaction" (p. 1331). Borup et al. (2020) in their qualitative case study found that most of the students believed that student-student interaction helped in learning by instructing, befriending, collaborating, and motivating.

In a learner-centered online education teacher's role is supportive and facilitating. Students are encouraged to interact with peers and to collaborate, thus socially constructing new knowledge, making them more engaged and feeling empowered. Or, as Gray (2016) commented, "The role of the instructor became refashioned to help students construct knowledge rather than reproduce facts" (p. 10). Similarly, Kauffman (2015) observed that the online learners were more satisfied with the courses that were "structured, interactive, i.e., constructivist instructional design, relevant, i.e., application based with practical significance, and instructor facilitated in terms of interactions/feedback" (p. 8). Social interaction in online education is also seen to have positive impact on the technological skills of the learners.

> From the group interactions perspective, social environment factors, such as collaborative learning, learning climate and social interaction are important antecedents of beliefs about using an e-learning system. Prior research shows that social interaction has a direct effect on the usage of an e-learning system. (Yi-Cheng et al., 2013, p. 1331)

One would wonder, if interaction and most of the characteristics and skills discussed under learning behavior are equally relevant and are practised in face-to-face learning, why most of the studies are suggesting online education superior in terms of outcomes? The answer is technology. Use of ICT is the factor that makes the difference. Groff (2013) explains this by saying,

> The benefits of ICT-driven education … [e.g.] – engagement & motivation, student-driven learning & inquiry, interactivity & collaboration, personalisation & flexibility, and innovating – are all enabled and enhanced with ICT. They are of course possible without ICT—you can still engage and motivate, personalise learning and facilitate collaboration, without any technology at all. However, at scale, technology greatly increases our opportunity and capacity for these outcomes. (p. 16)

Technology offers far more possibilities to learners, as well as to teachers, to suit to the individual and group needs. As observed by Mayer et al. (2017), "WC [web communication] technologies can support simultaneous communication over several different channels, or media….[including] a shared whiteboard that participants may contribute to anonymously and that enables students to import, collaboratively share, and annotate various types of documents" (p. 15).

ICTs have expanded the opportunities for knowledge sharing and knowledge creation through expanded social interaction and collaboration. This has a direct bearing on the quality and relevance of education. Means et al. (2013) state that "learning technology researchers too see the Internet not just as a delivery medium but also as a potential means to enhance the quality of learning experiences and outcomes… [They] agree that online technologies can expand and support community of learners promoting "participatory models of education" (p. 4).

Students' ICT skills and proficiency level influence their learning outcomes both directly and indirectly. Many of the learning behavior elements as discussed earlier, for example time management, self-efficacy, collaboration and interaction (student-student, student-teacher, student-content), and motivation are contingent upon students having good ICT skills. Ho (2009) concludes that technology readiness and e-learning system quality, as perceived by the students, both have a significant positive influence on the online learning behavior of students. The author observes that learning behavior has stronger impact on learning outcomes in the presence of these two variables. Yi-Cheng et al. (2013) found that "the students who had higher computer self-efficacy will have higher learning outcome expectations, which in turn will lead to higher learning satisfaction" (p. 1334).

Mechanism of Mutual Growth

The behavioral, social and technological factors discussed above do not operate in silos. These factors, rather, are mutually dependent – Growth in one area provides energy to another and likewise. It will be relevant here to discuss little bit about how these factors build upon one another eventually contributing to high quality outcomes.

The impact of behavioral elements and factors on one another can be explained on the basis of self-efficacy theory (also known as social cognitive theory or social learning theory). It is about someone's belief in her/his capabilities to accomplish something or as Yi Cheng et al. (2013) puts it "learning outcome expectations as the perceived consequences of a behavior" (p. 1330). "Self-efficacy can create a positive spiral in which those with high efficacy become more engaged in their tasks and then, in turn, increase performance, which increases efficacy further" (Robins & Judge, 2013, p. 215). In other words, the likelihood of adopting a behavior that produces expected results is higher. It will be pertinent to discuss 'intentions' as well. "Intentions are considered to affect motivational factors that have an effect on a behavior" (Ozturk, 2012, p. 38). Yi-Cheng et al. (2013), studying a group on Taiwanese college students taking web-based online language learning (WBLL) class found their hypothesis to be true as "computer self-efficacy could reduce learning barriers in using WBLL systems" (p. 1330). They concluded that students having higher computer self-efficacy will perceive the systems useful thus motivating their intentions to use it.

As mentioned earlier, different components of the factors are mutually supporting. For example, the practice elements of the student's learning behavior e.g., attention, online preference, persistence (Ho, 2009) and time spent on learning activities (Darling-Aduana,

2019) strengthen the skill elements of learning behavior such as self-directing (Dabbagh, 2007), management of feelings, self-regulation, self-discipline, time management, organisation, planning (Kauffman, 2015) and study confidence (Ho, 2009). These skills, in turn, motivate (Kauffman, 2015) the students to spend more time in their learning activities. Similarly, collaboration and interaction with peers add quality and ease to the learning process, which is another motivating factor for students. This also explains Darling-Aduana's (2019) finding of behavioral engagement of students in a hybrid setting taking at least one online course. They attended, on average, three additional days of school when enrolled in an online course compared with when enrolled in solely face-to-face courses. The additional days attending regular school may suggest learners' enhanced self-regulation and motivation. According to Darling-Aduana, "possible mechanisms include improved self-confidence through regular, formative feedback, clearly communicated expectations, and short, modularized lessons" (p. 9).

Most of the studies referred here are based on recording students' perceptions and satisfaction levels. Student satisfaction is an indicator of their achievement, continued interest in their studies and a source of motivation for learning. Student satisfaction is linked to improved academic performance, continued learning (Sloan, n.d., as cited in Sinclaire, 2014). According to Sinclaire (2014), "In post-secondary education, student satisfaction is both an outcome of the learning process as well as a requirement for successful learning" (p. 2). This means that the student satisfaction and the learning outcome grow with each other interchanging causal relationship. The more satisfied online learner is with his/her learning outcomes, the more motivated s/he is and vice versa. Yi-Cheng et al. (2013) observe that higher learning outcomes result in higher learning

satisfaction. Or, as Gray (2016) noted, “Student satisfaction plays a vital role in student learning and persistence in online courses for graduate and undergraduate students” (p. 17). The level of satisfaction, sense of expected achievement and the enhanced level of motivation further strengthen the skills such as self-regulation, better time management and internal locus of control. “Satisfaction has proven to have the potential to influence motivation, retention, marketing, and recruitment efforts” (Gray, 2016, p. 90).

Conclusions

Most of the studies either found online learning more effective than or as good as the traditional face-to-face education. Very few studies showed otherwise results. There is no disagreement that the use of technology opens up many options for pedagogical innovations and for keeping the learners engaged and interacting. In online courses offered at K-12 and higher levels, this potential of technology seems to be instrumental in achieving better learning outcomes.

This Major Paper presents a set of variables or the ‘success factors’ that directly or indirectly affect students’ learning outcomes in online modality. The presence of these factors mutually reinforces the effect of one another by raising the attitude, skill and sense of achievement to a higher level, thus giving a boost to student motivation and satisfaction. These factors gain energy from one another thus spiraling upward and affecting the learning outcomes at an increasing rate. The reverse is also true; if one or more of them are lacking this negatively affects the impact of the remaining ones.

There is a dearth of studies and empirical research on online education outcomes at K-12 level. We observed that the factors influencing learning outcomes have been discussed at secondary and post-secondary levels alike. We also notice no discrepancies in

online learning outcomes when compared with face-to-face education at K-12 and above (e.g., Means et al., 2013).

> For the range of student types [K–12 students, undergraduate students (the largest single group), and other types of learners (graduate students or individuals receiving job-related training)] for which controlled studies are available, online learning appeared more effective than traditional face-to-face instruction in both older and newer studies, with both younger and older learners, and in both medical and other subject areas. (Means et al., 2013, p. 33)

However, as schools are switching to online education, there is an increased need of studying these variables in different, controlled, environments as well as looking into other variables that may have catalytic role. Also, with the ever-growing technological improvement, there is a need to continuously update the knowledge pool.

This study begins to provide a prototype of 'success factors' in an online modality for the K-12 learners. This recipe is based on the available research and is not a final word. However, this sets a new direction of research towards developing and improving a generalized, and not individualized, set of minimum prerequisites for better learning outcomes in online education. This and other future studies will provide next steppingstones towards more research while at the same time guiding the decision makers including the government authorities, school administration, teachers, parents and students to take right actions as relevant to their positions for a smooth transition from traditional to online education.

REFERENCES

Arzt, J. (2011). Online courses and optimal class size: A complex formula. Retrieved from https://files.eric.ed.gov/fulltext/ED529663.pdf

Blohm, K. (2017). *Online high school achievement versus traditional high school achievement.* (ProQuest Number: 10617557) [Doctoral dissertation, Walden University]. ProQuest LLC.

Borup, J., Walters, S., & Call-Cummings, M. (2020). Student perceptions of their interactions with peers at a cyber charter high school. *Online Learning, 24*(2), 207-224. https://doi.org/10.24059/olj.v24i2.2015

Center for Teaching Support and Innovation, University of Toronto. *What are learning outcomes?* Retrieved March 17, 2021, from https://teaching.utoronto.ca/teaching-support/course-design/developing-learning-outcomes/what-are-learning-outcomes/

Characteristics of public elementary and secondary schools in the United States: Results from the 2015–16 national teacher and principal survey. *NCES 2017-071 U.S. Department of Education.* https://nces.ed.gov/pubs2017/2017071.pdf

Dabbagh, N. (2007). The online learner: Characteristics and pedagogical implications. *Contemporary Issues in Technology and Teacher Education, 7*(3), 217- 226. https://www.learntechlib.org/primary/p/22904/

Darling-Aduana, J. (2019). Behavioral engagement shifts among at-risk high school students enrolled in online courses. *AERA Open, 5*(4), 1–19. https://doi.org/10.1177%2F2332858419887736

Darling-Aduana, J., Good, A., & Heinrich, C.J. (2019). Mapping the inequity implications of help-seeking in online credit-recovery classrooms. *Teachers College Record, 121*(11), 1-40.

Eady, M. J., & Lockyer, L. (2013). Tools for learning: Technology and teaching strategies. *Learning to Teach in the Primary School, Queensland University of Technology, Australia.*

Egan, K. (1978). What is curriculum? *Curriculum Inquiry, 8*(1), 65-72. https://doi.org/10.1080/03626784.1978.11075558

Freire, P. (1970). *Pedagogy of the oppressed.* 30th Anniversary ed. NY, The Continuum International Publishing Group Inc.

Glander, M. (2015, December 16). NCES blog. Retrieved March 17, 2021, from https://nces.ed.gov/blogs/nces/post/virtual-schools-measuring-access-to-elementary-and-secondary-education-in-online-environments

Gray, M. L. (2016). *Student satisfaction as an outcome of the frequency and type of teacher interaction in online courses.* (ProQuest Number: 10124227) [Doctoral dissertation, Northcentral University]. ProQuest LLC. https://www.proquest.com/docview/1807430426

Groff, J. (2013). Technology-rich innovative learning environments. Retrieved from http://www.oecd.org/education/ceri/Technology-Rich%20Innovative%20Learning%20Environments%20by%20Jennifer%20Groff.pdf

Hart, C., Berger, D., Jacob, B., Loeb, S., & Hill, M. (2019). Online learning, offline outcomes: Online course taking and high school student performance. *AERA Open*, *5*(1), 1–17. https://doi.org/10.1177%2F2332858419832852

Haynie, D. (2014, Sept. 26). *Experts say class size can matter for online students.* US News. Retrieved March 17, 2021, from https://www.usnews.com/education/online-education/articles/2014/09/26/experts-say-class-size-can-matter-for-online-students

Hew, K.F., & Brush, T. (2006). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*(3), 223-252. https://doi.org/10.1007/s11423-006-9022-5

Ho, L. (2009). The antecedents of e-learning outcome: An examination of system quality, technology readiness, and learning behavior. *Adolescence, 44*(175), 581-599.

Kaczorowski, J. (2009). Standing on the shoulders of giants: Introduction to systematic reviews and meta-analyses. *Canadian family physician Medecin de famille Canadien*, *55*(11), 1155-6. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2776811/

Kauffman, H. (2015). A review of predictive factors of student success in and satisfaction with online learning. *Research in Learning Technology, 23*, 1-13. https://doi.org/10.3402/rlt.v23.26507

Kerr, M.S., Rynearson K., & Kerr, M.C. (2006). Student characteristics for online learning success. *Internet and Higher Education*, *9*(2), 91-105. https://doi.org/10.1016/j.iheduc.2006.03.002

Keramati, A., Afshari-Mofrad, M., & Kamrani, A. (2011). The role of readiness factors in e-learning outcomes: An empirical study. *Computers & Education 57*(3), 1919-1929. https://doi.org/10.1016/j.compedu.2011.04.005

Khan, S. (2020). *Meta-Analysis, Statistics for Biology and Health.* Springer Nature Singapore Pte Ltd. https://doi.org/10.1007/978-981-15-5032-4

Kirtman, L. (2009). Online versus in-class courses: An examination of differences in learning outcomes. *Issues in Teacher Education, 18*(2), 103-116.

Leung, M., & Fung, M. (2005). Enhancement of classroom facilities of primary schools and its impact on learning behaviors of students. *Emerald Insight, 23*(13/14), 585-594. https://doi.org/10.1108/02632770510627561

Lin, C-H., Kwon J.B., & Zhang Y. (2018). Online self-paced high-school class size and student achievement. *Educational Technology Research and Development, 67,* 317–336. https://doi.org/10.1007/s11423-018-9614-x

Mayer, G., Lingle, J., & Usselman, M. (2017). Experiences of advanced high school students in synchronous online recitations. *Educational Technology & Society, 20*(2), 15–26. https://www.jstor.org/stable/90002160

Means, B., Toyama, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record*, 115(3), 1-47. https://agronomy.unl.edu/online/documents/Effectiveness_of_online_learning.pdf

Media Smarts. (2019). *Use, understand & create: A digital literacy framework for Canadian schools.* Retrieved March 17, 2021, from https://mediasmarts.ca/teacher-

resources/digital-literacy-framework/use-understand-create-digital-literacy-framework-canadian-schools-overview

Miron, G., & Gullosino, C. (2016). *Virtual schools report 2016: Directory and performance review.* Boulder, CO: National Education Policy Center.

Mupinga, D. M., Nora, R.T., & Carole-Yaw, D. (2006). The learning styles, expectations, and needs of online students. *College Teaching, 54*(1), 185-189. https://doi.org/10.3200/CTCH.54.1.185-189

National Center for Education Statistics (NCES). (n.d.). *National Teacher and Principal Survey (NTPS).* Retrieved March 17, 2021, from https://nces.ed.gov/surveys/ntps/tables/ntps1718_2019082303_s12n.asp

Nguyen, T. (2015). The effectiveness of online learning: Beyond no significant difference and future horizons. *MERLOT Journal of Online Learning and Teaching, 11*(2), 309-319.

OECD Digital Economy Outlook 2015. *OECD Publishing, Paris.* Retrieved from https://read.oecd-ilibrary.org/science-and-technology/oecd-digital-economy-outlook-2015_9789264232440-en

Oestmann, E., & Oestmann, J. (2005). Relationship between online class size and student discussion interactivity. Retrieved from http://www.digitalinspirations.com/dvescio/teachonline-fall2010/CLASSSIZE.pdf

Öztürk E. Ö. (2012). *Contemporary motivation theories in educational psychology and language learning: An overview.* Retrieved from https://www.researchgate.net/publication/298210125

Packer, S. K. (2018). *A comparison study of high school math student performance and perceptions between blended and online learning.* (ProQuest Number: 13421667) [Doctoral dissertation, A&M University-Commerce]. ProQuest LLC. Retrieved from https://www.proquest.com/docview/2166132895

Panagiotis, G., & Nikolarea, E. (2012). Primary school pupils' ICT literacy in Northern Aegean. *Mediterranean Journal of Social Sciences, 3*(1), 21-31. Retrieved from https://www.richtmann.org/journal/index.php/mjss/article/view/10939

Parks-Stamm, E. J., Zafonte, M., & Palenque, S. M. (2017). The effects of instructor participation and class size on student participation in an online class discussion forum. *British Journal of Educational Technology, 48*(6), 1250-1259. https://doi.org/10.1111/bjet.12512

Parkes, S., Zaka, P., & Davis, N. (2011). The first blended or hybrid online course in a New Zealand secondary school: A case study. *Computers in New Zealand Schools: Learning, teaching, technology, 23*(1), 1-30.

Prøitz, T.S., & Nordin, A. (2018). Learning outcomes in Scandinavian education through the lens of Elliot Eisner. *Scandinavian Journal of Educational Research, 64*(5), 645–660. https://doi.org/10.1080/00313831.2019.1595717

Robins, S., & Judge, T. (2013). *Organizational behavior*. 15th ed. NJ, Pearson Education, Inc.

Santos, G., Ramos, E., Escola, J., & Reis, M. (2019). ICT literacy and school performance. *The Turkish Online Journal of Educational Technology, 18*(2), 19-39. Retrieved from https://files.eric.ed.gov/fulltext/EJ1211197.pdf

Siemens, G. (2004). Connectivism: A learning theory for the digital Age. *International Journal of Instructional Technology and Distance Learning, 2*(1), 3-10.

Sinclaire, J. K. (2014). An empirical investigation of student satisfaction with college courses. *Research in Higher Education Journal, 22*, 1-21. Retrieved from https://eric.ed.gov/?id=EJ1064140

Student outcomes definition. (2013, October 14). *Glossary of Education Reforms.* Retrieved March 17, 2021, from https://www.edglossary.org/student-outcomes/

Taylor, J. (2001). Fifth generation distance education. *Global Learning Services. The University of Southern Queensland Toowoomba, Queensland, Australia 4350.* Retrieved from https://eprints.usq.edu.au/136/1/Taylor.pdf

Turley, C., & Graham, C. (2019). Interaction, student satisfaction, and teacher time investment in online high school courses. *Journal of Online Learning Research, 5*(2), 169-198. Retrieved from https://www.learntechlib.org/primary/p/209812/

Wang, F. H. (2017). An exploration of online behaviour engagement and achievement in flipped classroom supported by learning management system. *Computers & Education, 114*, 79-91. https://doi.org/10.1016/j.compedu.2017.06.012

Yi-Cheng, C., Ron, C. Y., Shi-Jer, L., & Yi-Chien, L. (2013). What drives a successful Web-based language learning environment? An empirical investigation of the critical factors influencing college students' learning satisfaction. *Procedia - Social and Behavioral Sciences, 103*, 1327 – 1336. https://doi.org/10.1016/j.sbspro.2013.10.463

Zhang, Y., Liu, H., & Lin, C-H. (2018). Research on class size in K-12 online learning. Retrieved from https://www.researchgate.net/publication/326698027

VITA AUCTORIS

NAME:	Sajjad Ismail
PLACE OF BIRTH:	Rawalpindi, Pakistan
YEAR OF BIRTH:	1965
EDUCATION:	F.G. Public Secondary School, Rawalpindi, 1981
	University of the Punjab, B.Sc., Lahore, Pakistan, 1986
	University of the Punjab, B.Ed., Lahore, Pakistan, 1990
	University of the Punjab, M.A., Lahore, Pakistan, 1993