

**THE DESIGN AND DEVELOPMENT OF NEXT  
GENERATION LEARNING SPACES (NGLS)  
FRAMEWORK IN TEACHERS' PEDAGOGY AND  
TECHNOLOGY TOOLS**

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FRAMEWORK IN TEACHERS' PEDAGOGY AND  
TECHNOLOGY TOOLS**

by

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## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENT</b> .....	<b>ii</b>
<b>TABLE OF CONTENTS</b> .....	<b>iii</b>
<b>LIST OF TABLES</b> .....	<b>viii</b>
<b>LIST OF FIGURES</b> .....	<b>xiii</b>
<b>LIST OF ABBREVIATIONS</b> .....	<b>xv</b>
<b>LIST OF APPENDICES</b> .....	<b>xvi</b>
<b>ABSTRAK</b> .....	<b>xviii</b>
<b>ABSTRACT</b> .....	<b>xx</b>
<b>CHAPTER 1 INTRODUCTION</b> .....	<b>1</b>
1.1 Introduction.....	1
1.2 Background of the Study.....	4
1.3 Problem Statement .....	10
1.4 Research Objectives .....	13
1.5 Research Questions .....	14
1.6 Significance of the Research.....	15
1.7 Limitations of the Research Study .....	17
1.8 Operational Definitions of Terms .....	18
1.8.1 Teachers’ Pedagogy .....	18
1.8.2 Technology Tools .....	18
1.8.3 Next Generation Learning Spaces (NGLS) .....	19
1.8.4 Next Generation Learners .....	19
1.9 Summary .....	20

<b>CHAPTER 2</b>	<b>LITERATURE REVIEW.....</b>	<b>21</b>
2.1	Introduction.....	21
2.2	Next Generation Learning Spaces (NGLS).....	21
2.2.1	Flexible Learning Spaces .....	24
2.2.2	Physical Context of NGLS.....	26
2.2.3	Makerspace as a Conceptualized NGLS.....	32
2.2.4	Next Generation Learners .....	40
2.3	Teachers’ Pedagogy in NGLS.....	44
2.3.1	Technology Tools .....	51
2.4	Review of the Theories .....	56
2.4.1	Connectivism Theory .....	56
2.4.2	Relationship between Connectivism Theory and Teachers’ Pedagogy in NGLS .....	56
2.4.3	Understanding of Situated Learning Theory in NGLS .....	57
2.4.4	The Needham Model.....	60
2.4.5	Learning Spaces Framework: Pedagogy-Space-Technology.....	61
2.4.6	Model of Blended Learning .....	65
2.4.7	The TUP Model .....	68
2.5	Theoretical Framework.....	70
2.6	Conceptual Framework.....	71
2.7	Summary .....	72
<b>CHAPTER 3</b>	<b>METHODOLOGY.....</b>	<b>73</b>
3.1	Introduction.....	73
3.2	Research Design.....	73
3.2.1	Needs Analysis Phase .....	75

3.2.1(a)	Need Analysis Phase Procedure .....	77
3.2.1(b)	Research Population and Sample .....	78
3.2.1(c)	Research Instrument .....	81
3.2.1(d)	Instruments Validity and Reliability .....	82
3.2.1(e)	A Pilot Test for Needs Analysis .....	83
3.2.1(f)	Data Analysis.....	85
3.2.2	Design and Development Phase.....	88
3.2.2(a)	Research Population and Sampling .....	88
3.2.2(b)	Fuzzy Delphi Instruments.....	89
3.2.2(c)	Design and Development Data Collection Procedure ...	90
3.2.2(d)	The Strength of the Fuzzy Delphi Method as an Effective Measurement Method.....	91
3.2.2(e)	Data Analysis Procedure .....	94
3.2.2(f)	Instrument Validity and Reliability .....	101
3.2.2(g)	The Development of the Framework.....	102
3.2.3	Evaluation Phase .....	104
3.2.3(a)	Research Population and Sampling .....	104
3.2.3(b)	Research Instruments.....	106
3.2.3(c)	Data Collection Procedure.....	107
3.2.3(d)	Data Analysis.....	110
3.2.3(e)	Instruments and Contents Validity .....	112
3.3	Summary .....	114
<b>CHAPTER 4 RESULTS AND DISCUSSION .....</b>		<b>115</b>
4.1	Introduction.....	115
4.2	Findings for Phase 1: Needs Analysis.....	115

4.2.1	Respondents Demographic .....	117
4.2.2	Need for Learning Spaces .....	118
4.2.3	Need for Pedagogy Approach.....	121
4.2.4	Needs of Technology Tools .....	123
4.3	Summary of Needs Analysis Findings.....	131
4.4	The Findings for Phase 2: Design and Development.....	132
4.4.1	Findings for the Objective of NGLS Framework Elements .....	135
4.4.2	Findings for Selection of Learning Spaces Elements .....	139
4.4.3	Findings for the Types of Pedagogy Strategies Elements.....	143
4.4.4	The Type of Teaching and Learning Activities Elements Findings	146
4.4.5	Findings for the Selection of Technology Tools Elements.....	149
4.4.6	The Types of Technology Application Tools for Homework Elements Findings.....	152
4.4.7	The Types of Technology Tools for Tests and Quizzes Findings	155
4.4.8	The Types of Technology Application Tools for Coding and Programming Findings.....	157
4.4.9	The Types of Technology Application Tools for Online Tutorial Findings.....	160
4.4.10	The Types of Technology Application Tools for Online Learning Findings.....	162
4.4.11	Findings for the Aspect of Opportunities in Implementation Elements.....	165
4.5	Prototype of the NGLS Framework .....	169
4.6	Summary of the Findings in Design and Development Phase .....	174
4.7	Evaluation Results.....	175
4.7.1	Informant Demographic .....	176
4.7.2	How to Evaluate the Usability of the NGLS Framework in the Learning Spaces Aspect? .....	179

4.7.3	How to Evaluate the Usability of the NGLS framework in the pedagogical aspect?.....	181
4.7.4	How to Evaluate the Usability of the NGLS Framework in the Technology Tools Aspect?.....	184
4.7.5	What is the Impact NGLS Framework for secondary school teachers?.....	186
4.8	Summary of Evaluation Phase .....	190
<b>CHAPTER 5 DISCUSSION AND CONCLUSION .....</b>		<b>191</b>
5.1	Introduction.....	191
5.2	Discussion of Main Findings .....	191
5.2.1	Discussion on Needs Analysis Phase 1 .....	191
5.2.2	Design and Development Findings Discussion .....	195
5.2.3	Evaluation Phase Discussion .....	198
5.3	Conclusion of the Main Findings Discussion .....	202
5.4	The Implications of the Research.....	203
5.4.1	Theoretical Implications .....	204
5.4.2	Practical Implications.....	207
	5.4.2(a) Implications to the Ministry of Education Malaysia (MOE).....	207
	5.4.2(b) Implications on the Secondary School Teachers.....	208
	5.4.2(c) Implications to the Secondary School Students .....	208
	5.4.2(d) Contributions to the New Field of Knowledge.....	209
5.5	Future Recommendations.....	210
5.6	Conclusion.....	210
<b>REFERENCES.....</b>		<b>212</b>
<b>APPENDICES</b>		
<b>LIST OF PUBLICATIONS</b>		



## LIST OF TABLES

		<b>Page</b>
Table 1.1	Champion Schools in Malaysia .....	8
Table 2.1	A Typology of Learning Spaces .....	28
Table 2.2	The Descriptions of Makerspaces in Malaysia .....	37
Table 2.3	Champion Schools in Malaysia .....	39
Table 2.4	Creating Makerspaces in School.....	39
Table 2.5	A Typology of Student-Centred Pedagogies .....	46
Table 2.6	Next Generation Learning Space Student-Centred and Next Generation Classroom Student-Centred .....	47
Table 2.7	Pedagogical Implications of Technology Use .....	50
Table 2.8	Digital Learning Platform: DELIMa .....	53
Table 2.9	A Pedagogic Framework for Use in Next Generation Learning Spaces .....	57
Table 2.10	Applying Needham Model in Design and Development of the Framework.....	60
Table 2.11	Pedagogy-Space-Technology (PST) Framework .....	64
Table 3.1	A Summary of the Two Types of Design and Development Research .....	74
Table 3.2	Common Methods Employed in Design and Development Research	75
Table 3.3	Needs Analysis Respondents .....	80
Table 3.4	Research Instrument Summary for Needs Analysis .....	82
Table 3.5	Reliability Report for the Pilot Study .....	85
Table 3.6	Needs Analysis Interpreting Mean.....	86

Table 3.7	Numbers of an Expert in Each Field.....	89
Table 3.8	Summary Reference Sources of the Item’s Variable .....	90
Table 3.9	Summary of Variables Items .....	90
Table 3.10	Linguistic Variables for the Important Weight of Criteria 7-Point Likert Scale.....	95
Table 3.11	Linguistic Variables for the Important Weight of Criteria 5-Point Likert Scale.....	96
Table 3.12	Linguistic Variables for the Important Weight of Criteria 7-Point Likert Scales .....	96
Table 3.13	Linguistic Variables for the Important Weight of Criteria 7-Point Likert Scale.....	97
Table 3.14	Comparison Between the 7-Point Likert Scale and 5-Point Likert Scale .....	98
Table 4.1	Mean Score Interpretation Table .....	117
Table 4.2	Respondents' Demographic.....	117
Table 4.3	Analysis for Section B in Developing the NGLS Framework in Teachers’ Pedagogy and Technology Tools.....	119
Table 4.4	Analysis for Section C in Developing the NGLS Framework in Teachers’ Pedagogy and Technology Tools.....	122
Table 4.5	Analysis for Hardware Tools (Section D) in Developing the NGLS Framework in Teachers’ Pedagogy and Technology Tools .....	124
Table 4.6	Analysis for Homework (Section D) in Developing the NGLS Framework in Teachers’ Pedagogy and Technology Tools .....	125
Table 4.7	Analysis for Test and Quizzes (Section D) in Developing the NGLS Framework in Teachers’ Pedagogy and Technology Tools .....	126
Table 4.8	Analysis for Coding and Programming (Section D) in Developing the NGLS Framework in Teachers’ Pedagogy and Technology Tools ..	127

Table 4.9	Analysis for Online Tutorial (Section D) in Developing the NGLS Framework in Teachers' Pedagogy and Technology Tools .....	128
Table 4.10	Analysis for Online Learning (Section D) in Developing the NGLS Framework in Teachers' Pedagogy and Technology Tools .....	129
Table 4.11	Developing the Main Construct Based on 5-Phase Needham Model .....	132
Table 4.12	The Reference Sources of the main Constructs and Elements .....	133
Table 4.13	Experts' Experience Analysis .....	134
Table 4.14	The Objectives of NGLS Framework Elements .....	135
Table 4.15	The Threshold Value (d) Based on Experts' Consensus .....	136
Table 4.16	The Expert Consensus and Ranking of the Elements .....	137
Table 4.17	Summary of the Defuzzification Table for the Objective Elements	138
Table 4.18	The Selection of Learning Spaces Elements.....	139
Table 4.19	The Threshold Value (d) Based on Experts' Consensus .....	140
Table 4.20	The Expert Consensus and Ranking of the Elements .....	141
Table 4.21	Summary of the Defuzzification Table for the Selection of the Learning Space Elements .....	142
Table 4.22	The Types of Pedagogy Strategies Elements.....	143
Table 4.23	The Threshold Value (d) Based on Experts' Consensus .....	144
Table 4.24	The Expert Consensus and Ranking of the Elements .....	145
Table 4.25	Summary of the Defuzzification Table for the Selected Types of Pedagogy Strategies Elements .....	145
Table 4.26	The Types of Teaching and Learning Activities Elements.....	146
Table 4.27	The Threshold Value (d) Based on Experts' Consensus .....	147
Table 4.28	The Expert Consensus and Ranking of the Elements .....	148

Table 4.29	Summary of the Defuzzification Table for the Selected Teaching and Learning Activities Elements.....	148
Table 4.30	The Types of Hardware Applications in NGLS .....	149
Table 4.31	The Types of Hardware Applications Elements .....	150
Table 4.32	The Experts' Consensus and the Ranking of the Elements .....	151
Table 4.33	Summary of the Defuzzification Table for the Selected Types of Hardware Application Elements.....	151
Table 4.34	The Types of Technology Tools for Homework .....	152
Table 4.35	The Types of Technology Tools for Homework .....	153
Table 4.36	The Experts' Consensus and the Ranking of the Elements .....	154
Table 4.37	Summary of the Defuzzification Table for the Selected Types of Technology Application Tools for Homework.....	154
Table 4.38	The Types of Technology Tools for Tests and Quizzes .....	155
Table 4.39	The Types of Technology Application Tools for Tests and Quizzes	155
Table 4.40	The Experts' Consensus and the Ranking of the Elements .....	156
Table 4.41	Summary of the Defuzzification Table for the Selected Types of Technology Application Tools for Tests and Quizzes.....	157
Table 4.42	The Types of Technology Application Tools for Coding and Programming Elements.....	158
Table 4.43	The Types of Technology Application Tools for Coding and Programming.....	158
Table 4.44	The Experts' Consensus and the Ranking of the Elements .....	159
Table 4.45	Summary of the Defuzzification Table for the Selected Types of Technology Application Tools for Coding and Programming .....	159
Table 4.46	Types of Technology Application Tools for Online Tutorial Elements .....	160

Table 4.47	Types of Technology Application Tools for Online Tutorial.....	160
Table 4.48	The Experts' Consensus and the Ranking of the Elements .....	161
Table 4.49	Summary of the Defuzzification Table for the Selected Types of Technology Application Tools for Online Tutorial .....	162
Table 4.50	Types of Technology Application Tools for Online Learning Elements .....	163
Table 4.51	Types of Technology Application Tools for Online Learning .....	163
Table 4.52	The Experts' Consensus and the Ranking of the Elements .....	164
Table 4.53	Summary of the Defuzzification Table for the Selected Technology Application Tools for Online Learning.....	164
Table 4.54	Aspects of Opportunities in the Implementation of NGLS Elements .....	165
Table 4.55	Aspects of Opportunities in the Implementation of NGLS .....	166
Table 4.56	The Experts' Consensus and the Ranking of the Elements .....	167
Table 4.57	Summary of the Defuzzification Table for Selecting Opportunities in Implementation Elements .....	168
Table 4.58	The Acceptable Elements' Summaries in Developing the NGLS Framework .....	170
Table 4.59	The Informants' Demographic .....	176

## LIST OF FIGURES

	<b>Page</b>
Figure 2.1 The Design of the Future Classroom Lab, Incorporating Six Learning Zones. Source: (Ayre, 2017).....	32
Figure 2.2 School Infrastructure Requirement; Physical Learning Spaces and Technology Used. Source: (Ministry of Education, 2013).....	54
Figure 2.3 Pedagogic Framework Use in NGLS. Source: (Ling & Fraser, 2014).....	59
Figure 2.4 Pedagogy-Space-Technology Framework. Sources: (Radcliffe, 2008).....	62
Figure 2.5 The Relationship Between Technology, Space, Pedagogy and NGLS Usability in the TUP model. Source: (Bednarik et al.,2004).....	68
Figure 2.6 Theoretical Framework.....	70
Figure 2.7 Conceptual Framework.....	71
Figure 3.1 Design and Development Research Design.....	73
Figure 3.2 Design and Development Research Design.....	74
Figure 3.3 Need Analysis Procedure.....	87
Figure 3.4 The Triangular Fuzzy Number.....	99
Figure 3.5 Fuzzy Delphi Procedure Flow .....	101
Figure 3.6 Summary of Design and Development Phase Research Procedure Flow .....	103
Figure 3.7 Summary of Evaluation Phase Flow.....	113
Figure 4.1 oPSTi Prototypes Framework.....	173

Figure 5.1      Development of the oPSTi Framework with the Integration of the  
Discrepancy Model, Needham Model, TUP Model, Connectivism  
Theory, and Situated Learning Theory .....206

## LIST OF ABBREVIATIONS

NGLS	Next Generation Learning Spaces
IR	Industrial Revolution
Frog VLE	Virtual Learning Environment Frog
TPACK	Technological Pedagogical Content Knowledge
PST	Pedagogy-Spaces-Technology
DDR	Design and Development Research
TUP	Technology Usability Technology
FDM	Fuzzy Delphi Method
MOOC	Massive Open Online Courses
MOE	Ministry of Education
MDEC	Malaysia Digital Economy Corporation (MDEC)
OECD	The Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goal
DELIMa	Digital Educational Learning Initiative Malaysia



## **LIST OF APPENDICES**

APPENDIX A	LETTER OF APPROVAL TO CONDUCT THE RESEARCH
APPENDIX B	STUDENT STATUS CONFIRMATION LETTER
APPENDIX C	LETTER OF APPROVAL TO CONDUCT THE RESEARCH FROM JPN PERLIS
APPENDIX D	LETTER OF APPROVAL TO CONDUCT THE RESEARCH FROM JPN PENANG
APPENDIX E	ACKNOWLEDGE LETTER TO PRINCIPAL
APPENDIX F	LETTER OF APPROVAL TO CONDUCT THE RESEARCH FROM JPN PERAK
APPENDIX G	LETTER OF APPROVAL TO CONDUCT THE RESEARCH FROM JPN KEDAH
APPENDIX H	EXAMPLE OF VALIDATION CONSENTMENT LETTER FOR NEED ANALYSIS QUESTIONNAIRES
APPENDIX I	SURVEY PROTOCOL
APPENDIX J	SURVEY CONSENTS FORM
APPENDIX K	NEED ANALYSIS INSTRUMENTS
APPENDIX L	THE EXAMPLE OF THE INSTRUMENT VALIDATION BY THE EXPERT
APPENDIX M	SURVEY PROTOCOL FOR DESIGN AND DEVELOPMENT PHASE
APPENDIX N	EXPERT'S SURVEY CONSENTS FORM

APPENDIX O	EXAMPLE OF VALIDATION CONSENTMENT LETTER FOR DESIGN AND DEVELOPMENT FOR MAIN CONSTRUCT
APPENDIX P	DESIGN AND DEVELOPMENT INSTRUMENTS FOR MAIN CONSTRUCT
APPENDIX Q	EXAMPLE OF VALIDATION CONSENTMENT LETTER FOR DESIGN AND DEVELOPMENT FOR ELEMENTS OF CONSTRUCT
APPENDIX R	DESIGN AND DEVELOPMENT INSTRUMENTS FOR ELEMENTS OF CONSTRUCT
APPENDIX S	EXAMPLE OF THE EXPERT VALIDITY FOR THE INSTRUMENT
APPENDIX T	EXAMPLE OF VALIDATION CONSENTMENT LETTER FOR SEMISTRUCTURED INTERVIEW PROTOCOL
APPENDIX U	THE EXAMPLE OF THE INSTRUMENT VALIDATION BY THE EXPERT (SEMISTRUCTURED INTERVIEW)
APPENDIX V	SEMISTRUCTURED INTERVIEW PROTOCOL
APPENDIX W	LETTER OF CONSENT TO PARTICIPATE
APPENDIX X	SEMISTRUCTURED INTERVIEW INSTRUMENT
APPENDIX Y	INFORMANT SEMISTRUCTURED INTERVIEW TRANSCRIPTION

**MEREKABENTUK DAN MEMBANGUNKAN KERANGKA RUANG  
PEMBELAJARAN GENERASI SETERUSNYA (NGLS) DALAM PEDAGOGI  
GURU DAN ALAT TEKNOLOGI**

**ABSTRAK**

Pendidikan Malaysia sedang bergerak pantas ke arah pendigitalan dan penggunaan teknologi dalam pengajaran dan pembelajaran. Guru sekolah menengah juga perlu bergerak pantas ke arah penggunaan alatan teknologi sebagai platform utama dalam pengajaran dan pembelajaran dalam norma baharu. Objektif utama penyelidikan adalah untuk mereka bentuk serta membangunkan rangka kerja ruang pembelajaran generasi akan datang (NGLS) yang dikenali sebagai rangka kerja oPSTi. Rangka kerja ini dibangunkan berdasarkan tiga fasa pendekatan reka bentuk dan pembangunan (DDR). Dapatan Fasa 1 menunjukkan guru memerlukan garis panduan yang betul untuk memahami konsep alat teknologi dalam pedagogi guru. Kaedah "Fuzzy Delphi" (FDM) digunakan dalam Fasa 2 dengan kesepakatan 13 orang pakar. Sebelas elemen yang diterima dalam konstruk objektif, sembilan elemen dalam ruang pembelajaran, lapan untuk strategi dan aktiviti pedagogi, 27 untuk alatan teknologi dan tujuh untuk pelaksanaan rangka kerja oPSTi. Elemen yang diterima adalah berdasarkan nilai peratusan konsensus pakar antara 75% hingga 100%, dan nilai ambang adalah lebih rendah daripada ( $d \leq 0.2$ ). Penyahfuzzifikasi juga menunjukkan nilai alfa  $\alpha \geq 0.5$  untuk pemeringkatan unsur yang diterima. Dapatan Fasa 3 juga menunjukkan semua informan bersetuju dengan aspek ruang pembelajaran, pedagogi, dan kebolegunaan alatan teknologi dalam rangka kerja oPSTi. Kesimpulannya, keputusan

menunjukkan bukti kukuh tentang kebolegunaan rangka kerja dan menyokong peralihan daripada pembelajaran tradisional kepada ruang pembelajaran generasi akan datang.

**THE DESIGN AND DEVELOPMENT OF NEXT GENERATION  
LEARNING SPACES (NGLS) FRAMEWORK IN TEACHERS' PEDAGOGY  
AND TECHNOLOGY TOOLS**

**ABSTRACT**

Malaysian education is rapidly moving toward the digitalization and use of technology in teaching and learning. The new norm demonstrates that secondary school teachers also have to move rapidly toward using technology tools as the main platform in teaching and learning. The main research objectives are to design and develop the NGLS framework, known as oPSTi framework. The framework is developed based on the three phases of the Design Development Research (DDR) approach. The Phase 1 findings showed that the teachers need a proper guideline to understand the concept of technology tools in teachers' pedagogy. The Fuzzy Delphi Method (FDM) analyzes the findings in Phase 2 with 13 experts' consensus. The 11 accepted elements in the objectives construct involved nine elements in learning spaces, eight for pedagogies strategies and activities, 27 for technology tools, and seven for implementing the oPSTi framework. The accepted elements are based on the expert consensus percentage values ranging from 75% to 100%, and the threshold value is lower than 0.2 ( $d \leq 0.2$ ). The defuzzification also showed the value of alpha cut  $\alpha \geq 0.5$  for the ranking of the accepted elements. The Phase 3 findings also illustrated that all the informants agreed with the aspect of learning spaces, pedagogy, and usability of the technology tools in the oPSTi framework. In conclusion, the results showed strong evidence of the framework's usability and support the transition from traditional learning to next generation learning spaces.

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Rapid changes and developments in teaching and learning worldwide have affected countries, societies, economies, schools, and education systems for upcoming education trends (Ministry of Education, 2018). New teaching approaches have emerged in recent years. Evolution is linked to learning processes, which necessitate research into the structure and organization of learning areas (Byers et al., 2018a; Byers & Imms, 2016). The Organisation for Economic Co-operation and Development (OECD) is an international organization focusing on learning spaces for future education.

To develop students' capacities for the 21<sup>st</sup> century, stakeholders must activate and reshape the learning spaces to stimulate the pedagogies, curriculum assessment, and organizational forms (Fullan et al., 2018; López et al., 2019). 2030 Agenda for Sustainable Development (SDG) recognizes education's vital role. Sustainable Development Goal 4 (SDG4-Education 2030) will ensure the education system must be relevant and responsive for future generations to develop creative and critical thinking, collaborative skills, and pedagogy embedded with technology. SDG4 requires a suitable teaching method that uses appropriate pedagogical approaches to meet all learners' needs. Therefore, the proper technology tools, and an inclusive and adequately resourced environment support the facilitation of learning (UNESCO, 2016, 2020).

Education is already forecasting the next revolution for education 5.0 and preparing for next-generation learners after less decade of education talk in era 4.0. Digital citizens who interact in a digital age are also next-generation learners. Teachers and students

interact through social networks, cloud-based platforms, and apps (Azlina Musa et al., 2021; P. Bala & Tan, 2021; Johnson, L., Adams Becker, S., Cummins, M., 2014). Learning spaces must be aligned with the standards, curriculum, purpose and contents of education, teaching, and learning. Formal and informal learning are activities that occur in classrooms or outside the classroom, or in ubiquitous learning spaces with interactions among peers. Learning space can be physical or virtual, and impacts learning for next-generation learners (Oblinger et al., 2006). The researcher will focus on designing the next generation learning spaces framework in teachers' pedagogy and technology tools.

The main goal of this research study is to deeply explore the impact of the NGLS on Malaysian education in future. According to Boys (2015), NGLS is a technology-enabled pedagogies (Boys, 2015; Carr & Fraser, 2014). NGLS is purposely designed to facilitate technology in learning spaces, seamless connections, encourage collaboration among learners, and activate active learning (JISC, 2006; Mitchell et al., 2010; Nambiar et al., 2018; Oblinger, 2005; Radcliffe et al., 2008b; Ramu V et al., 2020; Riddle & Souter, 2012). NGLS includes formal and informal spaces in the education context, physical, and electronic spaces (Oblinger et al., 2006). Teachers and students enjoy comfortable furniture that can be rapidly modified to fit various pedagogies (Morrone & Workman, 2014).

Teachers' creativity, innovation, strategies, and approaches are essential in implementing pedagogy in new spaces (Ishak & Jamil, 2020). The availability of this platform, and the creation of a new learning environment, have opened up new and exciting opportunities for teaching and learning in NGLS. According to Campbell (2020) and Nambiar et al. (2018), NGLS, also known as flexible learning spaces, are represented in

various forms including physical, virtual, formal, informal, blended, mobile, outdoor, personal, and practice-based.

Generally, the main characteristic of a flexible learning space is to support a variety of pedagogy. Teachers can guide and approach next-generation learners in active learning, encourage collaboration among peers, application of technology tools in blended learning, flipped, group work, experimentation, and role-playing (Radcliffe et al., 2008a). NGLS need to be student-centred and supported by appropriate technologies (Carr & Fraser, 2014; Fraser, 2014a, 2014b). Students benefit from blended learning; from face-to-face to technologically enabled learning space without time constraint for them to master the learning contents (Hensley, 2020; Keppell & Riddle, 2012). The use of adaptive software products offers teachers the flexibility to combine traditional face-to-face instructional strategies with technology-enabled experiences without spending much time (Cronje, 2020; Hrastinski, 2019). However, teachers without adaptive software can still make these decisions and provide effective blended learning opportunities for students in NGLS (Prouty, 2014; Smith & Hill, 2019). A blended learning methodology is a blend of formats used in an educational environment to improve learning.

Although there is no one model to define the perfect learning space, previous researchers conducted a theoretical examination of three convergence elements of fundamental analysis for its conceptual design, pedagogical, environmental, and technological characteristics related to the NGLS (López et al., 2019). In conclusion, from the empirical support, there is a need to design and develop the NGLS framework in teachers' pedagogy and technology tools to enhance and encourage the effectiveness of technology tools in teaching and learning.



## **1.2 Background of the Study**

Many types of learning spaces support teaching and learning transformation in NGLS. Some include learning studios, flipped classrooms, active learning classrooms, lecture rooms, writing centres, learning commons, and makerspaces (Sparrow & Whitmer, 2014). Makerspaces are environments where students themselves initiate in learning. The teachers merely guide, support, and improve the knowledge. Makerspace comprises technology, tools, space, and community to provide the students with digital space to learn, explore, and use the space effectively in their own style (Bruno Schardong et al., 2020; Graves, 2014; M.Yaqoob Koondhar et al., 2021; Salisbury & Nichols, 2020). Therefore the researcher will focus on makerspaces, such as conceptualized NGLS in this study. Makerspaces are environments in which participants (or "makers") design or produce (or "make") projects with a variety of physical and digital instruments (Salisbury & Nichols, 2020). Makerspaces are how teachers have to use NGLS to empower students' learning, merging both formal and informal learning, support it with cardinal pedagogy approach, and embed it with technology tools. The makerspaces are part of NGLS, a teaching model that breaks through the education barriers of the traditional teaching model to a creative teaching method. The makerspaces combine the pedagogy approach and digital tools to explore and practise learning based on stimulating students' needs (Balakrisnan et al., 2021; Sang & Simpson, 2019; Sun & Zhang, 2019).

Therefore, transitioning from a traditional approach, such as teacher-centred to more collaborative and interactive learning spaces can make the teaching and learning process livelier and more interesting (Ana Haziqah A.Rashid et al., 2021; Imms & Mahat,

2021). Teachers must move from a traditional environment to work in blended, online modes in ubiquitous spaces (French et al., 2020; Redmond, 2011).

Blended learning is defined in many different ways (Cronje, 2020; Hrastinski, 2019). The principle of blended learning in NGLS is an instructional approach that enables teachers to personalized their teaching and learning by using the combination of the technology tools and meeting face-to-face. In NGLS, students move through the learning process and can choose to spend additional time reviewing to mastering the learning contents supported by their teachers without time and place barriers (Cronje, 2020; Nuruzzaman, 2016; Prouty, 2014). According to Christensen et al (2013), blended learning is emerging in numerous K-12 schools as a hybrid innovation. Hensley (2020) mentioned that “a hybrid is a combination of the new, disruptive technology with the old technology and represents a sustaining innovation relative to the old technology”Click or tap here to enter text.. Students benefit from the advantages of technology-enabled learning experiences combined with the advantages of a traditional classroom.

In NGLS, the concept of makerspace has become a way to encourage further collaboration and active learning. This enthusiasm has resulted in an explosion of makerspaces around the world in various instructional learning environments, including independent non-profit and for-profit groups, secondary schools, and higher education institutions (M.Yaqoob Koondhar et al., 2021; Rosenfeld & Sheridan, 2014).

The researcher indicates to introducing a new literacy that is particularly relevant for assessing learning in makerspaces. There seems to be a consensus of possibilities to pair teachers' pedagogy with informal and formal education, supported with technology tools to empower, and prepare for next generation learners. NGLS, as makerspaces, have begun to

move into classrooms, school libraries and other related spaces to encourage formal and informal learning (Eui Suk, 2018; Marsh et al., 2017; Nurul Natrah & Ahmad Shidki, 2020). Teachers' pedagogy are steadily involved to thrive in new generation and environmental circumstances where creativity, collaboration, and critical thinking are essential.

Nowadays, the famous buzzword among scholars is that education in the next generation is related to Revolution Industry 5.0 (IR 5.0) (Aslam et al., 2020; Oke & Fernandes, 2020). The Malaysia Education Blueprint 2013-2025 has set clear objectives for inculcation of 21<sup>st</sup>-century learning. The Blueprint comprises a range of competencies, such as critical thinking, collaboration, creativity, communication, and digital technology literacy to face the challenges of the 5.0 education revolution (Kim et al., 2019; Ministry of Education, 2015; Ponniah et al., 2019). The Ministry of Education (MOE) also aims to boost the learning environment by enabling all school students to access digital learning through collaboration with the private sector (Economic Planning Unit, 2021). The Malaysia Education Blueprint 2013-2025 (MEB 2013-2025) entered the third wave from 2020 -2025 (Ministry of Education, 2013). Therefore, Malaysian classrooms have taken the grand move to transform their classroom into suitable learning spaces to fit with the digitalization in education (Bahagian Teknologi Pendidikan & Kementerian Pendidikan Malaysia, 2016).

In this regard, NGLS in Malaysian contexts, such as ME.REKA, KakiDIY, MakerLAB, Fab Space KL, Arus Academy, and online makers learning are developed for the elite community in Malaysia (Balakrisnan et al., 2021; Svensson & Hartmann, 2018). Makerspace also bloomed vigorously throughout Malaysia in colleges, institutions,

shopping malls, universities, and hubs in state government, such as Penang Science Cluster in Penang as a non-profit organisation, Selangor Creative Centre (SDCC), Digital Perak in Perak and many more (Balakrisnan et al., 2021). The researcher piqued the interest of NGLS in bringing the makerspace concept into secondary school learning spaces to offer instructors and students opportunities to engage in collaboration, creativity, and active learning.

The 21<sup>st</sup>-century skillset is widely accepted to include a variety of competencies like critical thinking, digital and technological literacy, as well as preparation for the challenges of the 5.0 education revolution (Kim et al., 2019). The MOE is also navigating the future of education by deploying a revised Information and Communication Technology (ICT) in the curriculum. Hence, secondary schools in Malaysia must cultivate digital skills and concentrate on the basic infrastructure of learning spaces to deploy formal and informal learning in teachers' pedagogy (Economic Planning Unit, 2021; Ministry of Education, 2013). Thus, in response to such demand, MOE proposed a structure for coordinating education efforts to build agile and competent digital talent, as stated in Four Thrusts of Malaysia Digital Economy Blueprint (Economic Planning Unit, 2021).

The four thrusts initiative can accelerate the adoption of technologies and create interactive learning spaces among the students and teachers in secondary schools in Malaysia. Currently, to assist in the transition of Malaysian education to digitalization, MOE has introduced The Digital Learning Initiative Malaysia (DELIMa) as a digital technology initiative for teaching and learning (Economic Planning Unit, 2021). In collaboration with Google, Microsoft, and Apple (Microsoft, 2020). DELIMa offered various digital services and applications to embrace technology in teachers' pedagogy and

technology tools in NGLS. The application can be used in formal and informal learning, such as Google Classroom, Microsoft 365, and Apple Teacher Learning Centre. Therefore, educationalists who want to NGLS can unlock the true potential of every student who uses them (Kirkpatrick et al., 2020).

The My Digital Maker Champion Schools is an example of NGLS’s conceptualization in Malaysia’s secondary schools. To create active learning and student-centred, the teachers and students will equip with the necessary digital skills and technology tools in new learning spaces. The Champion Schools have initiated programs between MOE and Malaysia Digital Economy Corporation (MDEC) (Malaysia Digital Economy & MDEC, 2019). Table 1.1 illustrates the numbers of the Champion Schools in Malaysia (Malaysia Digital Economy & MDEC, 2019).

Table 1.1 Champion Schools in Malaysia

<b>No.</b>	<b>States</b>	<b>Secondary Schools</b>	<b>Primary Schools</b>
1.	Perlis	1	0
2.	Kedah	0	1
3.	Penang	0	1
4.	Perak	1	0
5.	Selangor	1	3
6.	Putrajaya	1	1
7.	Kuala Lumpur	0	1
8.	Melaka	1	0
9.	Johor	0	1
10.	Negeri Sembilan	2	0
11.	Pahang	1	0
12.	Terengganu	0	1
13.	Kelantan	1	1
14.	Sarawak	1	0
15.	Sabah	1	3
	<b>Total</b>	<b>11</b>	<b>13</b>

Sources: *Champion School Playbook (Malaysia Digital Economy & MDEC, 2019)*

Table 1.1 above shows only 11 secondary and 13 primary schools are engaged in the NGLS' conceptualized programs under MOE and MDEC. Malaysia has 2,439 secondary schools, which 1,790 are located in urban areas and 649 in rural areas. The number of secondary school classes is 79,204 (Educational Macro Data Planning Sector & Ministry of Education Malaysia, 2020). Table 1.1 illustrates that NGLS conceptualized in secondary schools have been implemented in Malaysia. However, the implementation of the NGLS only involved 11 schools which is 0.5% of the total number of secondary schools in Malaysia. Therefore, MOE needs to expand the implementation of NGLS conceptualization in secondary schools by increasing the number of secondary schools involved. Thus MOE's commitment to expand the number of Champion Schools across the nation to 2,500 schools through its My Digital Maker Champion Schools initiative under the timeline of Phase 1 to Phase 2 (2021-2030) (Economic Planning Unit, 2021).

The NGLS allow collaboration, communication, and teamwork for teachers and students beyond classroom walls to meet the needs of next-generation learners and facilitate, for instance, flexibility in teaching and learning, collaboration, and critical thinking (Benade, 2017). The NGLS conceptualized schools will develop collaborative and critical thinking among the students and enhance teachers' pedagogy in preparing the next generation of learners. NGLS can unlock the true potential of every student who uses them and significantly impact teachers' pedagogical strategies, class activities, and livelier student interest and outcomes (Kirkpatrick et al., 2020; Muhd Zulhilmi Haron et al., 2020; Nambiar et al., 2018).

According to the Quick Facts 2020 Malaysia Educational Statistics Report, MOE has 179,770 teachers teaching in secondary schools in Malaysia (Educational Macro Data

Planning Sector & Ministry of Education Malaysia, 2020). Nevertheless, in Malaysian public schools, learning space is insufficient and undermined in design approaches and teaching aids (Alice Sabrina Ismail & Sufrie Abdullah, 2018; Zamri Sahaat, 2020). New learning spaces, teaching strategies, and technology tools will impact teachers' pedagogy (Mulcahy et al., 2015; Nambiar et al., 2018; Nurkhamimi Zainuddin & Rozhan Idrus, 2018). However, teachers' pedagogy and teaching approaches are inactive when current learning spaces do not optimize the next generation's learning (Ahmad et al., 2018; Allison, 2018; Nikian et al., 2013a, 2013b; Omar & Ismail, 2020; Siti Noor Ismail et al., 2022). Therefore, in this study, the researcher's main aim is to develop a suitable framework for NGLS in teachers' pedagogy and technology tools in secondary schools in Malaysia.

### **1.3 Problem Statement**

The MOE initiative aims to create an exciting environment for 21<sup>st</sup>-century learning. Teachers were found to still focus on the challenging 21<sup>st</sup> century learning skills and managed to discover technology tools in learning spaces suited to their needs and enabled teaching and learning inside and outside walls (Muhd Zulhilmi Haron et al., 2020; Noorashid, 2019; Radin & Yasin, 2018). However, teachers confronted tough challenges and issues due to insufficient technological knowledge (Cheok et al., 2020; Muhamad Khairul et al., 2019). Other challenges include limited accessibility and network connection, limited technical support, lack of adequate training, limited time, and the teachers' lack of competency in using the technology tools (Ghavifekr et al., 2016). This situation caused an intense need among the teachers for a more comprehensive view of the framework in teachers' pedagogy that integrates technology to support teaching and learning (Carrillo & Flores, 2020). Learning spaces will impact students' outcomes,

teachers' pedagogy approach, and technology tools used in next-generation learners (Alice Sabrina Ismail & Sufrie Abdullah, 2018; Muhd Zulhilmi Haron et al., 2020; Nambiar et al., 2018).

The MOE has made various efforts to enhance the education system with greater quality of 21<sup>st</sup>-century skills (Ministry of Education, 2019). Blended learning and flipped learning are related to the elements of 21<sup>st</sup>-century skills. Based on the earlier research gap, it is suggested that blended learning has a negative impact on class dynamics, with students not engaging with teachers and other students. In addition, teachers have limitations on the supervision of students' blended learning. The obstacle to blended learning is the lack of effective infrastructure to apply teachers' understanding and skills in using ICT (Eka Yulia Syahrawati et al., 2022; Hrastinski, 2019; Wilda Albeta et al., 2023).

In various attempts to enhance teaching and learning with 21<sup>st</sup>-century skills, teachers face a tough challenge caused by their low expertise in teaching strategy and the understanding of the education revolution. Teachers must change traditional teaching approaches from teacher-centred to student-centred (Handayani et al., 2021). The transition techniques to technology-based learning focus on a student-centred approach compared with the chalk and talk approach (Fatimah & Hasmadi, 2019; Imms & Mahat, 2021; Salyani Osman et al., 2016; Siti Fatimah Abd Rahman et al., 2019). However, large class sizes, lack of teaching and learning facilities, and less conducive environment are vital challenges for teachers in implementing 21<sup>st</sup>-century teaching approaches for next generation learners (Jamilah Sulaiman & Siti Noor Ismail, 2020). Failure to shift the pedagogy approach from teacher to student-centred will impact the MOE's goal of fully allowing teachers to utilize



digital tools and technology in 21<sup>st</sup>-century pedagogies. (Kementerian Pendidikan Malaysia (KPM), 2019; Mohamed Nazrul Ismail, 2020).

Most teachers believe that online learning and technology tools are beneficial (Azlan et al., 2020; Fatimah & Hasmadi, 2019; Hashim & Shaari, 2020; Mardhiah Yahaya et al., 2021). Therefore, from the informal classroom observation, teachers who vigorously try to apply new technologies in their pedagogies confront tough challenges (Muhamad Khairul et al., 2019). However, insufficient learning space infrastructure and a lack of technological understanding may have resulted in a poor rate of integration of new technology tools (Athirah & Azlina, 2020; Jalil et al., 2021; Jamilah Sulaiman & Siti Noor Ismail, 2020; Mardhiah Yahaya et al., 2021; Ni Kadek Meri Listiani et al., 2021; Whai & Ling, 2020). Most teachers have to stop implementing technological tools in their pedagogy, and this scenario caused teachers to suffer from lack of confidence in using technology tools (Pick Chien & Mohamed Yusoff Mohd Nor, 2020).

The Malaysia Education Blueprint (MEB) 2013-2025 targeted to improve the efficient delivery of quality pedagogy by transforming technology in education to ensure teachers and students can leverage it effectively to enhance teaching and learning (Ministry of Education, 2013). However, the analysis conducted by MOE in 2010 resulted in only 80% of teachers spending less than one hour a week using technology in their pedagogy. Despite that, only a third of students perceive their teachers regularly using technology in their pedagogy approach. According to MOE's Smart School Qualification Standard (SSQS) report in 2020, only 41%-60% of teachers use student-centred virtual learning environments in Cluster E for teaching and learning. The weakness value of 0.76 on five

scales of indicator illustrated for using ICT tools for teaching and learning (Kementerian Pendidikan Malaysia, 2020).

This situation indicates that MOE lags in technology integration in education even though various training and facilities have been provided (Ministry of Education, 2013; UNESCO, 2016, 2020). Therefore, in this study, the researcher focused on designing and developing the NGLS framework in teachers' pedagogy and technology tools in secondary schools in Malaysia. This study can provide a framework to be used by teachers to enhance teachers' pedagogy strategies in terms of technology used in the NGLS framework in teaching and learning.

#### **1.4 Research Objectives**

The research study aims to develop the NGLS Framework in teachers' pedagogy and technology tools. The specific objectives of the research are as follows:

1.4.1 Phase 1 - To identify the needs of the NGLS Framework in teachers' pedagogy and technology tools in terms of:

1.4.1.1 The appropriate forms of learning spaces used in NGLS in secondary schools in Malaysia.

1.4.1.2 The appropriate types of pedagogy strategies in NGLS in secondary schools in Malaysia.

1.4.1.3 The types of technology tools used in NGLS in secondary schools in Malaysia.

1.4.2 Phase 2 - To design and develop of NGLS Framework in teachers' pedagogy and technology tools in terms of:

1.4.2.1 The objectives of the NGLS Framework.

1.4.2.2 The types of learning spaces in NGLS Framework.

1.4.2.3 The types of teachers' pedagogy in NGLS Framework.

1.4.2.4 The types of technology tools in NGLS Framework.

1.4.2.5 The implementation of the NGLS Framework.

1.4.3 Phase 3 – To evaluate the usability of the NGLS Framework in teachers' pedagogy and technology tools in terms of:

1.4.3.1 The usability of the NGLS Framework in the learning spaces factor.

1.4.3.2 The usability of the NGLS Framework in the pedagogies factor.

1.4.3.3 The usability of the NGLS Framework in the technology tools factor.

1.4.3.4 The impact of the NGLS Framework for secondary school teachers.

## **1.5 Research Questions**

The following research questions are created to acquire the essential information based on the objectives of this research study. The research questions are as follows:

1.5.1 Phase 1: Need Analysis - What are the needs of the NGLS Framework in teachers' pedagogy and technology tools in terms of:

1.5.1.1 What are the appropriate forms of learning spaces used in NGLS in secondary schools in Malaysia?

1.5.1.2 What are the appropriate pedagogy strategies in next NGLS in secondary schools in Malaysia?

1.5.1.3 What types of technology tools are used in NGLS in secondary schools in Malaysia?

1.5.2 Phase 2: Design and Development - How to design and develop of NGLS framework in teachers' pedagogy and technology tools in terms of:

1.5.2.1 What are the objectives of the NGLS Framework?

1.5.2.2 What types of learning spaces are in the NGLS Framework?

1.5.2.3 What types of teachers' pedagogy in the NGLS Framework?

1.5.2.4 What types of technology tools in the NGLS Framework?

1.5.2.5 What is the implementation of the NGLS Framework?

1.5.3 Phase 3: Evaluation - What is the justification for the usability of the NGLS framework in teachers' pedagogy and technology tools?

1.5.3.1 What is the usability of the NGLS Framework in the learning spaces aspect?

1.5.3.2 What is the usability of the NGLS Framework in the pedagogies aspect?

1.5.3.3 What is the usability of the NGLS Framework in the technology tools aspect?

1.5.3.4 What is the impact of the NGLS Framework for secondary school teachers?

## **1.6 Significance of the Research**

The research studies intend to contribute to designing the NGLS Framework in teachers' pedagogy and technology tools by assessing the relationship between learning spaces, pedagogy, and technology tools used. The previous research focused on 21<sup>st</sup>-century skills and technology tools used in pedagogy by using either relationship between

learning spaces or technology tools, and learning spaces or pedagogy approach but not both of them simultaneously (Ana Haziqah A.Rashid et al., 2021; Karpudewan & Meng, 2017; Kim et al., 2019). This research intends to fill the gap in the lacking of the earlier research study, the effects of learning spaces, teachers' pedagogy, and technology tools used in secondary schools.

The researcher investigated diverse learning spaces and teachers' pedagogy skills aligned with technology tools. Consideration was given to contributing factors related to how teachers facilitated learning in different settings, embedded with teaching spaces and technology tools towards the NGLS Framework. The research also provides valuable inputs and evaluation for teachers to design and create exciting lessons in formal and informal spaces. To help teachers modify their current practices to fit and be relevant for the next generation of learners in the 21<sup>st</sup> century (Economic Planning Unit, 2021; Ministry of Education, 2013).

This research should take a holistic look into the field of education, and match the physical environment and technology to the current concept of learning, not forgetting the pedagogical issues when designing new learning spaces. In addition, stakeholders should try to anticipate and predict the rapidly evolving technological change in future education. As a result, the findings are essential in Malaysia since the information gained can provide input and feedback to policymakers and leaders regarding future classroom arrangements. NGLS is in line with 21<sup>st</sup>-century skills for the next generation as a class for the future. Stakeholders should implement the NGLS Framework as a new learning space that promotes co-ordination and collaborative processes of teachers and students. The

technological support will assist teachers in teaching and learning for next-generation learners to attain the learning objectives.

### **1.7 Limitations of the Research Study**

In this study, the researcher aims to develop the NGLS framework in teachers' pedagogy and technology tools in secondary schools in Malaysia. Teachers need the framework to enhance teaching using technology tools in new learning spaces. In this study, three primary constructs represent the NGLS Framework; pedagogy, space, and technology (Radcliffe et al., 2008a, 2008b). These three constructs represent the best of the NGLS framework and are closely related to current education for next generation learners. The researcher only focused on these three constructs, and other variables are not taken into this study.

The respondents are in the Northern Region of Malaysia and involved secondary school teachers in Penang, Perak, Kedah, and Perlis. Therefore, other regions are not involved in this study. In developing the framework, the expert panels are from i) learning space experts, ii) curriculum experts, iii) technology experts, and iv) senior lecturers who served more than 10 years in education. All the expert panels graduated with a doctorate of philosophy degree (PhD) in education. For the Evaluation phase, the researcher used the usability test. This phase involves three teachers from the *Bestari* coordinator group who have experience in this field for more than 10 years.

In this study, a constraint revealed by the researcher could be viewed as a significant opportunity to identify new gaps in the preceding literature and demonstrate the need for additional development in the studied field. The researcher does not examine the impact of a particular learning space or pedagogical practice on educational outcomes but

concentrates on the interplay between learning space, teachers' pedagogy, and technology tools in the design and development of the NGLS Framework.

## **1.8 Operational Definitions of Terms**

The following terms are defined as specifically applied in this study to facilitate a clear understanding:

### **1.8.1 Teachers' Pedagogy**

Teachers' pedagogy is defined as the academic work that the teachers are responsible for covering, and the teachers' willingness to embrace and expose the limitations of their content knowledge (Emdin, 2012). Pedagogy as an approach to teaching is the theory and practice of learning, and how this process influences learners' social, physical, political, and psychological development (Kumar Shah, 2021). In the context of this study, project-based learning (PBL), flipped classroom (FC), active learning (AL), student-centred learning (SCL), and blended learning (BL) act as the variables of the teachers' pedagogy.

### **1.8.2 Technology Tools**

Technology tools are software that can create and support online course content. Blogs, wikis, authoring tools, such as Articulate or Captivate, and Web 2.0 tools available online are examples of technology tools. This research defines technology tools as Google Classroom, Google Meet, YouTube, Zoom, WhatsApp, Telegram, and Web 2.0 tools that are available online. Technology tools also refer to hardware tools, such as laptops, tablets, mobile, interactive TV, and audio (Keppell & Riddle, 2012).

### **1.8.3 Next Generation Learning Spaces (NGLS)**

NGLS are environments where teachers and students optimize the space's perceived and actual affordances, enabling authentic learning interactions (Keppell, 2014). NGLS refers to three convergence learning spaces, technology, and pedagogy (Fraser, 2014a). NGLS is also known as formal and informal spaces, physical or virtual and electronic areas aligned with comfortable furniture to suit different pedagogies (Morrone & Workman, 2014; Schaik, 2014; Sparrow & Whitmer, 2014). NGLS is also intentionally designed to facilitate active learning, collaboration, and connection (Fraser, 2014a). In this study, NGLS refers to new pedagogy's strategies in formal and informal learning, physical, and virtual spaces embedded with technology tools. Makerspaces are an example of the NGLS concept already applied in several secondary schools in Malaysia. NGLS fosters creativity, collaboration, and critical thinking in formal and informal spaces.

### **1.8.4 Next Generation Learners**

This term refers to students from generation Alpha, representing a new generation in a new century (McCrindle & Fell, 2020). In this study, citizens in the digital age are characterized by having a relationship with technology as next-generation learners. Next-generation learners in the digital age require knowledge, skills, and attitudes toward technology tools.



## **1.9 Summary**

This research study aims to develop a suitable framework for NGLS in teachers' pedagogy and technology tools, which teaching takes place and how it has helped enhance teaching in the IR 5.0 education revolution. The study is designed to understand better the impact of learning spaces in pedagogy and technology tools in next-generation learning, and how the teacher's pedagogy and technology tools enhance NGLS. This chapter provides a general overview of the study's purpose, significance, and structure.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Chapter 2 begins with reviewing the literature on NGLS concepts in teachers' pedagogy and technology tools, and discusses the earliest findings from other scholars and researchers regarding theories and applications of the NGLS. The following section provides an overview of some referred models about learning spaces, teachers' pedagogy, and technology tools. The discussion begins with defining NGLS, teachers' pedagogy, and technology tools in NGLS and a review of the theories. In this research, the researcher will concentrate on the definition of NGLS, Makerspace as a conceptualized of NGLS, flexible learning space, and pedagogy strategies, such as teacher-centred, student-centred, blended, personalized and project-based learning related to technology tools in NGLS. A summary of the review of literature ends this chapter.

#### **2.2 Next Generation Learning Spaces (NGLS)**

The Carrick Institute for Teaching and Learning in Higher Education in Australia supported a nationwide project called Next Generation Learning Spaces in 2006, centred at the University of Melbourne (Radcliffe et al., 2008a, 2008b). The main concern in this research is learning spaces and the research seeks to create a systematic and comprehensive framework for guiding the design and operation of new learning spaces. The report "*Designing Spaces for Effective Learning, the Guide for the 21<sup>st</sup>-century learning design*" by Click or tap here to enter text. Joint Information Systems Committee (JISC) in 2006 investigated the relationship between learning technology and new physical space design

concepts. A learning space as a concept to engage learners and encourage learning as an activity; it should facilitate collaboration in formal and informal practice; it should provide a personalized and inclusive environment, and it should be adaptable to changing needs. The positive response of students and teachers to new learning spaces has been a vital sign that new learning spaces are the new approach of the new generation of students (Qureshi et al., 2021).

The NGLS framework is a complete guide for designing and implementing new learning spaces. These spaces represent new learning approaches and creative uses of space in combination with technology and pedagogy (Radcliffe et al., 2008a). The researchers and practitioners from a wide range of disciplines; maintain that the learning space is a “third teacher” that can enhance students' potential to respond creatively and meaningfully to next-generation challenges (Fraser, 2014a; Fullan & Langworthy, 2014).

Finland recently embarked on an extensive school reform project that included using flexible and casual open-plan layouts to promote pleasant emotional experiences, collaborative working and engagement, and creativity (Halinen, 2018; The Finnish National Board of Education, 2016). Finland concentrates on implementing educational technologies using various programs, including maker practices in the new curriculum (Balakrisnan et al., 2021; Halinen, 2018; The Finnish National Board of Education, 2016). Many international schools in Asia, including International School in Thailand (NIST) and Changchun American International School in China, have embedded gameplay. The stakeholder took it a step further by creating opportunities for next-generation learners to design their own learning spaces and learn vital computer science skills (Marsh et al., 2017; M.Yaqoob Koondhar et al., 2021; Nambiar et al., 2018). Singapore also initiated NGLS as

a new learning space that facilitates teachers and students to promote collaboration, creativity, and self-directed learning in formal and informal physical or beyond the classroom (Chan See Mun et al., 2019). Currently, NGLS is being used to prepare a new curriculum (Marsh et al., 2017).

Teachers' pedagogical strategies are essential to understanding and adapting to the new learning space. The new learning space enables learners to think about the challenge through group collaborations embedded with innovative technological solutions. According to the Microsoft education team report, with an inclusive learning space and accessible tools and technology, students can participate and grow with confidence and independence in learning (Microsoft, 2018). Therefore, using digital learning tools, students can enjoy the group discussion to connect their academic world with iPad, laptops, tablets, smartphones, and smartwatches (Galway et al., 2020; Nambiar et al., 2018). Classrooms may need to be designed differently than in 1900, and students' active learning and knowledge are constructed. The students can build their understanding, and the learning space may range from project rooms to network access during class (Oblinger, 2005).

NGLS is a flexible learning space, including the furniture, lighting, ventilation, and technology tools that encourage teachers to think creatively about the ways to teach (Allison, 2018) in an informal environment or beyond the classroom. Learning spaces are illustrated as some form of study or learning. Physical/ virtual, formal/ informal, blended, mobile, outdoor, academic staff spaces, and personal and practice-based spaces are examples of flexible learning spaces (Keppell & Riddle, 2012). Teachers' pedagogy can be anytime and anywhere in formal or informal spaces without difficulty with their technology

tools. Hence, online learning is replacing traditional learning spaces as a learning source, while games and cell phones are replacing TV and blackboard in the classroom (Azlina Musa et al., 2021; Hockly, 2011; Ni Kadek Meri Listiani et al., 2021). Learning spaces impact the integration of technology such as mobile, robotic, and new digital tools that have emerged in the teaching spaces to implement methodologies in ubiquitous teaching spaces (López et al., 2019). Learning spaces are the best use of the diversity of spaces for teachers' pedagogy and technology tools in next generation learners.

The above literature explained the empirical research regarding the NGLS. Therefore, the researcher acknowledged the need to provide NGLS in this research study. The extensive reviews presented strong evidence that NGLS impacts future generation learners. The characteristic of NGLS was observed between last-generation learning spaces and those of next generation learning spaces, which has been made far more different than imagined. Moving away from the commonly held perception of learning spaces which ties learning in the classroom to learning in formal and informal with virtual and face-to-face embedded with suitable technology tools use. In the context of the research study, the three convergence of NGLS elements; pedagogy, learning space, and technology will be used to identify the relevant elements that in line with the current and future education.

### **2.2.1 Flexible Learning Spaces**

Flexible learning spaces can be defined as creating spaces of various sizes that accommodate various activities and individual needs (Allison, 2018; Bojer, 2019; George et al., 2009). According to Allison (2018), Classrooms are shared by teachers rather than "owned" by teachers. Flexibility could mean combining or dividing two or more classes into smaller groups based on their interests (Bisset, 2014). The learning studios incorporate