Research Article

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Received: 11 November 2021 / Accepted: 14 December 2021 / Published: 5 March 2022

The Role of School and Family Education in the Development of Creative Thinking for Youths: Evidence from Vietnamese Context

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DOI: https://doi.org/10.36941/jesr-2022-0034

Abstract

This article discusses determinant factors of creative thinking skills in students, including demographic features, within and out-of-school experiences, digital usage and ICT (Information and Communication Technology) skills. Structural equated model constructed from 1181 observations from Vietnamese secondary students reveals that students' digital usage and ICT skills, together with experiences within and outside school are strong predictors of their creativity levels. Demographic features, academic performance and after-school tuition are found insignificant to school learners' creative abilities. The results provide significant insights into the current situation of skills education and policy implications to improve instructional quality of Vietnam's education system and other nations with similar sociocultural contexts.

Keywords: *creative thinking, ICT, Vietnam's education system*

1. Introduction

Creativity, constant innovation, and dynamism have become vital elements of the economy, and the economy that requires creativity is the economy needed for a wealthy society, making public services better and at the same time creating more abundant personal property (Craft 2003; Cannatella 2004; Meleisea 2005). In the context of the knowledge economy, education has a crucial role and

responsibility in training human resources to meet the new requirements of society. According to Wuwei (2011): "The most important factor in a creative economy is education. There is a high correlation between a country's education level and the size and strength of its creative economy".

In the era of digitalization and knowledge economy, many developing countries are considered to have important economic activities as part of the creative economy (Nations 2008). However, there has not been much academic research in Vietnam on skills development of the labor force in the education system, particularly the manifestations and factors affecting the creativity skills of school students. Research examining the formation of students' creativity skills as informing tools for policymakers and educationalists is, therefore, a critical need.

This study was conducted in the context of Vietnam where education is still much focused on knowledge rather than skills development. The results are expected to bring meaningful insights to managers and authorities of all levels as well as specialists in the country and those from other nations with similar educational and socio-cultural contexts.

2. Literature Review

2.1 Creativity

Much research has focused on specifying the term "creativity" over the past decades, of which many confirmed this is a multidimensional construct (Treffinger 1993; Ellermeyer 1993; Puryear et al. 2019). Despite agreeing that there is no unified definition, most researchers highlighted two essential features of creativity: novelty and usefulness. Kaufman and Sternberg (2010), for example, proposed a model of creativity including 3 components: 'novelty, quality, and appropriateness. Runco and Beghetto (2019) have added 'authenticity, surprise, inconsistency, potentiality, appropriateness, and discovery'. Realizing the differences between Western and Eastern culture viewpoints on creativity, while Western notion focuses on individual features, the Eastern viewpoint emphasizes communal and ethical values connected to community, Kharkhurin (2014) suggested a 4-aspect definition of creativity including novelty, utility, aesthetics, and authenticity, based on the point of grasping cross-cultural variety.

Admitting the complexity and conflictive definition of creativity, Simonton (2017) proposed the definition of 'personal creativity (little-c) and 'consensual (Big-C) creativity' and sought to investigate the role of education in these two types of creativity. According to his research, Big-c creativity has broader coverage while little-c implies individual manifestations. Acknowledging the existence of many models of creativity, with the popularity of 'two-criterion and three-criterion models', Smith and Smith (2017) introduced the '1.5' criterion model including novelty and potentiality of being useful, proposing that creativity should be considered a process. The authors draw the notion of creativity as the process of coming up with a good idea. The current study adopted the definition by Smith and Smith (2017) that creativity skills involve the process of finding or creating original ideas/products. As such, creativity could be affected by individual and contextual environment, namely personal characteristics, individual experiential activities, school and family contexts.

2.2 Socioeconomic Background

The relationship between socioeconomic background and children's creativity has been found to be complex and multidimensional in a wide range of studies (Karwowski and Jankowska 2016; Parsasirat et al. 2013). Runco (2014) showed that children in families with lower economic status might be more creative because owning fewer toys enables them to imagine and think of their own ways to entertain. With regards to parents' academic background, Parsasirat et al. (2013) revealed a strong positive correlation between parents' education and creativity ($p < .01$). Heinla (2006) found that the creativity skills of teenagers are higher if one or both parents are university graduates, top specialists, or executives with high economic status.

2.3 Life experiences and Creativity

School-related Factors. When examining creativity skills, one of the most researched factors is academic performance (Gralewski and Karwowski 2012; Dziedziewicz et al. 2014; Gajda et al. 2017). Examining 589 students from 34 upper secondary schools in Poland, Gralewski and Karwowski (2012) discovered negative relation between creative abilities and students' GPA but in some separated schools, a strong and meaningful association could be found. Conversely, Tsai (2013) reported a significant effect of GPA on the creativity performance of 46 adult students. More recently, Gajda et al. (2017) analyzed 120 studies since 1960 to determine the relation between creativity and academic achievement. The authors concluded that the correlation was constant over decades but a stronger connection was found when creativity was assessed by creativity tests compared to self-reported assessment. In cases where academic achievement was assessed by standardized tests instead of normal grades and creativity was measured by verbal tests instead of figural tests, the relationship could be stronger.

Besides academic achievement, much evidence has been recorded on the benefits of school extracurricular activities such as camping, arts, and sports clubs (Atencio et al. 2015; Hubball and West 2009). A study examining art teachers, artists, and gallery educators in four secondary schools in London in collaborating with four galleries has demonstrated that students' creativity development could be improved by moving learning sites into the galleries (Burgess and Addison 2007). Also concerning education and creativity, an intervention study tested the effectiveness of the Creative Compass program on the intercultural and creative competencies of 122 students between the ages of 8 and 12 and showed that the program was highly effective to students' creativity in the aspects of divergent thinking and imagination (Dziedziewicz et al. 2014). The important role of collaborative activities in promoting students' creativity is also claimed by a variety of scholars. For example, storytelling and playing serious games could improve awareness and enhance learners' creativity (Pannese et al. 2009).

Out-of-school Activities. The impact of social context on creativity has been debated in numerous studies (Da Costa et al. 2015; Davis 2009; Baas et al. 2008; Hammond et al. 2011). Madjar et al. (2011), after having surveyed and interviewed 157 employees and their supervisors in Bulgaria, argued that resources for creativity and determination to embrace challenges have a strong impact on radical creativity. Outdoor activities in nature were also found to closely link to cognitive development and enhance innovative abilities in the secondary students' (Leong et al. 2014). The learning environment, defined as learning tasks, classroom activities, interactions among partakers, the of resources as well as physical setting (Richardson and Mishra 2018), has been proved to affect learners' creativity. Davies et al. (2013) reviewed 32 studies and concluded that both physical and social environment, namely time immerging in school and extracurricular activities, being in open space in or outside school, and the diversity of learning resources, is influential to students' creativity. Moreover, the authors also noted that learning tasks and activities that required learners to be creative and original seem to be an effective approach towards improving their creativity, especially in an atmosphere of democracy and encouragement, students are more willing to speak and express themselves.

Life experiences at home are also found important in the skills acquisition of students. Lew and Cho (2013) examined 150 pre-schoolers aged 5-6 from the middle-class socio-economic background and discovered a significant association between creativity skills and home environment. In addition, the role of parents at home in nurturing their children's creativity by participating actively in activities is also emphasized by scientists. Parental guidance and encouragement have discernible effects on children's creativity (Ellermeyer 1993; Robinson et al. 2013). Niu (2007) replicated this relationship on both Chinese and US subjects, showing that parents can enhance adolescents' creativity by inspiring openness and novel attitudes. Specifically, the author pointed out that parents valuing independence, freedom, and wellbeing could lead to more positive creative attitudes from adolescents. A supportive language environment at home was also reported to foster the creative

thinking of children. Using The Torrance creativity test and private speech coding on 32 preschool children, Daugherty and White (2008) examined the relationship between private speech with parents and children's social and cultural experiences as well as thinking way and found a positive association.

There has also been evidence for the benefits of academic activities at home, including doing homework, to creative skills. Contrary to the common belief that homework assignments are boring and discouraging to students' interest and creativity, Van Voorhis (2001) indicated that well-designed homework can positively enhance academic achievement as well as cognitive skills. In another study surveying reasons for giving homework, 85 Malaysian secondary school teachers were asked to rate the importance of giving homework following a four-point scale from very important (3) to unimportant (0) (North and Pillay 2002). The results revealed the role of doing homework in encouraging and facilitating learning, including stimulating creative learning methods in students. Similarly, scientists asserted that homework as project-based assignments support students' creativity and motivation to learn by sharing their creations and awareness about related concepts with others (VanDeGrift 2015; Xue et al. 2016). Furthermore, homework is found to help promote independent study habits, encourage responsibility, as well as stimulate imagination in the application of skills (Kukk et al. 2015; Murphy and Decker 1989).

Besides doing homework and assignments, independent reading at home also helps promote creative thinking skills. Mourgues et al. (2014) studied 259 college students from three Chilean universities and demonstrated a significant correlation between outcomes on the verbal ability tasks, and on the creativity tasks ($p < .001$). Scores of the reading comprehension in this study were the best predictor of performance on creativity tasks ($p < .05$). Not only reading proficiency, Wang (2012) also found that students who spent more time on reading/writing performed significantly better on creativity assessment tests. The author, therefore, confirmed the benefits of a positive attitude toward reading and writing to creative thinking performance.

2.4 Digital experiences, ICT proficiency, and Creativity

In the age of digitalization, children's life experiences are deeply involved with the digital world. As a result, their skills formation is much affected by ICT experiences and proficiency. Hsiao et al. (2014) conducted a study on 51 grade 4 Taiwanese students experiencing a system of digital game-based learning (DGBL) called the ToES. The results indicated that students' creativity showed positive growth when they learned in DGBL environment. In another study, the effects of the Robotics Club on scientific achievement and creativity skills were demonstrated on sixth and seventh-grade students who were encouraged to be scientific problem solvers in a real-life scenario (Cavas et al. 2012).

Many studies indicated the supportive effect of ICT on 21st-century skills in which creativity skills are involved (Ala-Mutka et al. 2008; Bush and Hall 2011; Anastasiades 2017; Casimaty and Henderson 2016). Around 91% of teachers in 19 countries asserted that the creativity of learners had improved through using a variety of digital tools to design and create technological products such as math games (Brinda et al. 2015). Specifically, the use of ICT can promote learners' creativity by growing ideas, leading connections by collaboration and communication, creating and doing with effective technology tools (Loveless 2002). Attempting to find out the effect of using online technologies on creative thinking, Wheeler et al. (2002) piloted 41 sixth-grade students and concluded that the contribution of ICT to the development of creative thinking displayed on 3 aspects: problem-solving, creative awareness, and social connection. Consistent with these findings, Mohammad et al. (2016) used an independent t-test on 100 students and found the experiment group in the e-learning environment had a significantly higher score than the control group. A possible explanation was that it is useful for the brainstorming progress when students access digital content, instead of starting with a blank paper they have a jump-starting with digital devices (Tackvic 2012). Not only exposing to educational software but having access to digital apps at home also contributes to the sharpening of the creative thinking (Marsh et al. 2016).

2.5 The current study

A review of extant literature has shown that creativity skills and determining factors have been widely researched. However, there is still a lack of studies focusing on secondary students with individual and environmental factors that might influence their formation of creative thinking skills. This investigation aims to take a landscape view at all of the comprehensive affecting factors on students' creativity, including demographic features, life experiences as well as technology usage and experiences. Specifically, our research questions are:

RQ1: Do demographic factors such as family socio-economic and academic background influence students' creativity skills?

RQ2: How do life experiences including activities at home and school relate to students' creativity skills?

RQ3: How do digital experiences and ICT skills affect creativity thinking of learners?

3. Materials and Methods

The survey was conducted from April to May 2019 on 1181 secondary school students, of whom 678 are females. The observations were collected through stratified sampling from 30 lower and upper secondary schools in rural and urban areas all over Vietnam. The questionnaire comprised 85 Likert scale multiple-choice items about sociodemographic, within-school, out-of-school factors in relation to respondents' self-assessment of their creative skills. Students filled out the paper questionnaires with the guidance and explanation of the researchers.

As mentioned earlier, the employed definition of creativity in this study is one proposed by Smith and Smith (2017). The reason is that from an educational perspective, students' creativity should be viewed as a thinking process where the criterion of "usefulness" is not mandatorily required even though a higher chance of success obviously indicates a higher degree of creativity. Students would benefit more from the process of idea generation, as long as the idea has an above-zero chance of success. Because of their alignments with Smith and Smith (2017)'s model, Beghetto (2006)'s creative self-efficacy scale was used in combination with self-rated questions extracted from the International Personality Item Pool (IPIP; ipip.ori.org) to assess individual creativity in this study. The IPIP scale items have been validated and utilized in several previous studies (Petway II et al. 2016; Niepel et al. 2015). Students were asked to rate their ability to address problems or phenomena from various dimensions, generate new ideas or new ways of doing things, design products to express their ideas, and critically evaluate and expand others' ideas. The self-assessment questions all employ a five-point Likert scale ranging from 1 (never or rarely) to 5 (Most of the time or always). Higher scores indicated a higher level of self-assessed creativity.

In this study, the internal consistency for the five-item self-rated scale was relatively good (α=.79) The observed scale mean was M = 2.82 (SD = 0.82).

The analytical results are based on the following independent variables:

Group 1: Demographic factors

Gender: Students' gender, with two categories: female and male

Birth order: Whether they are the "first child", "middle child" or "youngest child".

Parental education level: the highest education level of respondents' father and mother.

Socioeconomic status: the respondent's family socioeconomic status was determined on the basis of whether they have access to certain facilities and amenities at home such as, car, Internet access and laptop/computer. The observations were divided into two groups: wealthy and normal.

Group 2: Student's life experiences

Out-of-school activities: how much time they spend participating in non-academic and academic activities outside their schools' scope during weekdays and weekends. Activities such as attending skills classes, doing housework, volunteering, arts, and sports are non-academic. Academic

activities include doing homework, reading, and after-school academic tuition.

Interactions with parents: Students also provided the annual average time spent with parents on activities such as chatting and exchanging opinions, traveling, volunteering, or playing sports.

Within-school activities: Whether students have held leadership positions (Class President, Club Chairman, or Team Leader) and joined non-academic activities such as camping, speaking contests, Olympiad contests, and international exchange. Academic performance: students' GPA of the latest semester by subject.

Group 3: Digital experience and ICT skills

Digital experience: How much students are exposed to digital devices such as Projector, laptops, smartboards, and technological areas at school such as science labs, art areas, technological kitchen areas, engineering areas.

ICT skills: Respondents were asked to rate how proficient they are on a scale of 5 in applying technology for academic and creative purposes.

4. Results

We conducted simple linear regression models between the Creativity variable and the predictors of interest, i.e. demographic factors, academic background, life experiences, ownership of technological equipment, and ICT skills. The assessment of the predictors' contribution on Creativity level was based on the significance of coefficient test (by t-test) and ΔR^2-the change in R^2 when omitting each predictor from the regression models.

Research question 1: Do demographic factors such as socio-economic and academic background significantly correlate with students' creativity skills?

Simple linear regression was used to investigate the relationship between creativity skills and each of demographic factors and then a multiple linear regression model was constructed as the combination of all variables simultaneously.

There was no significant impact of parents' education levels on the outcome variable. Both linear regression and t-test yielded a significant effect of economic status on students' creativity: the wealthy group had significantly higher scores in creativity than the normal group (Table 1).

Table 1: Linear regression models between creativity skill and demographic variables

Model	β	s_β	t-test	R^2	ΔR^2
1. Creativity~ Socio-economic	0.738	0.241	3.069 (**)	0.00793	0.007927
2. Creativity~ Socio-economic	0.756	0.250	3.023 (**)	0.009	0.0077
Sex	-0.048	0.525	-0.199		3.3×10^{-5}
Order of birth	-0.012	0.140	0.931		6.3×10^{-6}
Father's education	0.10	0.110	0.364		7×10^{-4}
Mother's education	-0.127	0.113	-1.124		0.0011

When all these factors were combined together in detecting their impact on students' creativity, economic status turned out to have the most significant influence, in such a way that students with better economic conditions would achieve a higher score in creativity skills (as shown by the positive coefficient). The main contribution of economic status was supported by large ΔR^2 (0.0077) compared with the original value of R^2 (0.009), and the small change in the overall R-squared (from 0.00793 in model 1 to 0.009 in model 2).

Research question 2: How do life experiences relate to students' creativity skills?

Life experiences of students include Academic/Non-academic activities at home, Participation with parents, Academic/Non-academic activities at school, Study results. We conducted the linear regression models corresponding to these variables (from model 1 to model 6), and then included them in a multiple regression model 7.

Table 2: Linear regression models between creativity skill and students' life experiences

Model	Predictors	β	s_β	t-test	R^2	ΔR^2
1. Creativity ~ Academic activities at home	Doing homework	0.460	0.066	7.01(***)	0.0429	0.0399
	Attending tutorial classes	0.056	0.045	0.22		0.0012
2. Creativity~ Non-academic activities at home	Attending skill classes	-0.025	0.047	-0.53	0.105	0.0002
	Reading	0.324	0.062	5.21(***)		0.0207
	Doing housework	-0.192	0.068	-2.85(**)		0.0062
	Volunteers and extra-curricular activities	0.192	0.079	2.43(*)		0.0045
	Discussing with parents	0.261	0.060	4.39(***)		0.0147
	Art activities	0.267	0.066	4.03(***)		0.0124
	Sport activities	0.165	0.065	2.53(*)		0.0049
3. Creativity~ Participation with parents	Spending time	0.352	0.053	6.69(***)	0.111	0.0338
	Participating in activities	0.460	0.059	7.83(***)		0.0463
4. Creativity~Academic activities at school	Class Rep	0.312	0.325	0.96	0.0265	0.0008
	Club chairman	1.623	0.401	4.05(***)		0.0136
	Group leader	0.486	0.252	1.93(.)		0.0031
5. Creativity~ Non-academic activities at school	Going camping	0.829	0.245	3.39(***)	0.0807	0.0090
	Sports	1.107	0.275	4.03(***)		0.0127
	Speaking contest	2.022	0.317	6.38(***)		0.0318
	Olympiad contests	-0.207	0.344	-0.6		0.0003
	International exchange	1.035	0.344	3.01(**)		0.0071
6. Creativity~ Study results	Natural science subjects	0.024	0.036	0.67	0.0282	0.0004
	Social science subjects	0.204	0.057	3.60(***)		0.0107
7. Creativity~	Doing homework	0.267	0.062	4.27(***)	0.2261	0.0122
Academic acts at home +	Attending extra tutorial classes	0.020	0.043	0.47		0.0001
	Attending skill classes	-0.036	0.045	-0.80		0.0004
	Reading	0.235	0.059	3.95(***)		0.0104
Non-academic acts at home +	Doing housework	-0.122	0.065	-1.87(.)		0.0023
	Volunteers and extra-curricular activities	0.088	0.076	1.16		0.0009
	Discussing with parents	0.101	0.059	1.72(.)		0.0020
	Art activities	0.222	0.063	3.53(***)		0.0083
	Sport activities	0.131	0.065	2.02(*)		0.0027
Participation with parents +	Spending time with parents	0.212	0.053	3.97(***)		0.0105
	Activities with parents	0.273	0.058	4.67(***)		0.0146
	Class Rep	0.104	0.297	0.35		8×10^{-5}
	Club chairman	0.583	0.370	1.57		0.0017
	Group leader	0.291	0.231	1.26		0.0011
Academic acts at school +	Camping	0.289	0.233	1.24		0.0010
Non-academic acts at school +	Sports	0.472	0.271	1.74(.)		0.0020
	Speaking contest	1.410	0.302	4.67(***)		0.0146
	Olympiad contest	-0.377	0.323	-1.17		0.0009
	International exchange	0.666	0.322	2.07(*)		0.0029
Study results	Natural science subjects	0.016	0.034	0.47		0.0001
	Social science subjects	0.075	0.053	1.41		0.0013

As displayed in Table 2, attending extra tutorial classes bears no benefits to students' creativity skills, those who spend more time doing homework by themselves seemed to score significantly higher in creative abilities. Other activities also having positive correlation with creativity scores include reading, volunteering, extra-curricular activities, discussion with their parents, arts, and sports. Interestingly, the only activity bearing a negative correlation is doing housework.

Although Club Chairman just accounted for 11% of the surveyed students (131 out of 1181 observations), this leadership experience is highly related to students' creativity. The more School activities students participated in, the better creativity skills they developed. Particularly, four out of five listed activities at school (except for participation in Olympiad contests) had a significant effect on creativity scores.

Good result in Natural Science subjects or Social science subjects itself was significantly correlated to creativity level. However, when combining students' performance in both subject

groups in one linear regression model, the Social sciences group seemed to have the superior influence over the other.

In the multiple linear regression model combining all socioeconomic effects, there are 8 variables proving a positive relationship with creativity scores: Doing homework ($\Delta R^2 = 0.0122$), Reading ($\Delta R^2 = 0.0104$), Spending time on discussion, and talking with parents ($\Delta R^2 = 0.0105$), Spending time on activities with parents ($\Delta R^2 = 0.0146$), Speaking contest ($\Delta R^2 = 0.0146$), Participating in Art classes ($\Delta R^2 = 0.0083$), Participating in sports activities ($\Delta R^2 = 0.0027$), International exchange ($\Delta R^2 = 0.0029$). The overall R-squared in this multiple model was improved considerably to around 22.6% while the highest level in separated models was just 11% (model 3). Interestingly, good academic results and leadership positions did not play an essential role in deciding students' creative ability compared to other factors.

Research question 3: How does ownership of digital experiences and ICT skills affect the creativity ability of learners?

The results in Table 3 show that having access to computers at home and projectors at school were the only two contributors on the list to students' creativity. School infrastructures such as the specialized areas for art, exhibition, and the studio also contribute to fostering students' creativity.

Table 3: Linear regression models between creativity skills and technology factors

Model	Predictors	β	s_β	t-test	R^2	ΔR^2
1. Creativity~ Technology equipment at home and school	Personal computer	1.095	0.25	4.47(***)	0.0277	0.0166
	Desktop	0.300	0.29	1.00		0.0008
	Laptop	0.095	0.342	0.28		6×10^{-5}
	iPad	-0.026	0.586	-0.05		2×10^{-6}
	Projector	0.712	0.280	2.54(*)		0.0053
	Smart board	-0.065	0.308	-0.21		4×10^{-5}
2. Creativity~ Schoolinfrastructures	Science labs	-0.250	0.338	-0.68	0.0216	0.0004
	Art areas	1.124	0.303	3.71(***)		0.0114
	Kitchen technology areas	0.386	0.333	1.16		0.0011
	Engineering areas	0.389	0.380	1.02		0.0009
3. Creativity~ICT skills	ICT skills	0.392	0.002	16.99(***)	0.1967	0.1967
4. Creativity~ Technology equipment at home and school +	Personal computer	0.402	0.227	1.78(.)	0.2183	0.0021
	Desktop	0.114	0.276	0.41		0.0001
	Laptop	0.052	0.315	0.16		2×10^{-5}
School infrastructures +	iPad	0.133	0.532	0.25		4×10^{-5}
	Projector	0.428	0.254	1.69(.)		0.0019
	Smart board	0.174	0.277	0.63		0.0003
	Science labs	-0.911	0.337	-2.70(**)		0.0049
ICT skills	Art areas	1.031	0.274	3.76(**)		0.0095
	Kitchen technology areas	-0.049	0.305	-0.16		2×10^{-5}
	Engineering areas	0.049	0.349	0.14		1×10^{-5}
	ICT skills	0.383	0.024	16.18(*)		0.1751

When all of the variables are combined and considered, the predictors having a significant impact on the outcome creativity are science labs (negative effect with a coefficient of -0.911, and small value of $\Delta R^2 = 0.0049$), Art areas ($\Delta R^2 = 0.0095$), and ICT skills – the most influential predictor ($\Delta R^2 = 0.1751$). Though the R-squared value was increased into 22% in the combined model, ICT skills made most of contribution of about 17.5%.

4.1 Structural equation model

We constructed a structural equation model to see the relationship among creativity skills and three latent variables: Demographic factors, Life experiences, and Digital experiences and ICT skills (Figure 1). [Figure 1 near here]

The SEM plot showed good values of AGFI – adjusted goodness of fit index ($AGFI = 0.964 > 0.9$) and SRMR – standardized root mean square residuals ($SRMR = 0.053 < 0.08$), indicating that

our model is an appropriate choice.

In comparison with other factors, demographic features appear to have insignificant influence on students' creativity (β = -0.1, p = 0.51). Analysis of group 2 variables revealed that students' life experiences, including doing homework (A1.21), reading (A1.24), arts (A1.28), and sports (A1.29), together with their interactions with parents (shared discussion and activities), do moderately contribute to predicting students' creativity score (β = 0.25, p = 0.03). Compare to Life experiences, Digital experiences and ICT skills have twice as much influence on students' creativity (β = 0.53, p < 0.01), although both are positively significant in explaining the outcome. Life experiences have a clearer correlation with Digital and Technological skills than Demographic factors, which could be seen in their covariances. Among these three latent variables, Life experience and Technological skills are proved to be more important in predicting the students' creativity scores.

5. Discussion and Conclusions

This study aims to evaluate factors influencing students' creativity, including demographic features, life, and digital experiences. In particular, the considered aspects include socioeconomic background, activities within and outside school as well as digital proficiency of students. Overall, our findings show that students' digital experiences are the strongest predictor of their creative skills, followed by life activities. Demographic factors as well as academic performance, surprisingly, are not strongly associated with students' creative abilities. Before proceeding to the extensive discussion of our results, it is worth noting that due to the definition and measurement of creativity adopted in this study, the notion of "creative thinking" described in our results is limited to self-beliefs and judgments of one's ability to generate innovative ideas, which does not necessarily involve successful and practical outcomes.

5.1 Demographic factors

Findings of the insignificant role of parents' education level appear to be inconsistent with some previous studies (Parsasirat et al. 2013; Heinla 2006; Cavas et al. 2012). This might be due to the parenting style in Vietnam mainly prioritizes academic achievement and obedient behavior (Taneri 2012) while neglecting skills development. Moreover, many Vietnamese parents work away from home and have to leave their children under care by other relatives (Azubuike and Little 2019). Even in terms of cognitive skills such as Mathematics and literacy, the performance gap between advantaged and disadvantaged groups of Vietnamese students has been found to be relatively small. Since primary education in Vietnam has long reached universal enrolment and near 100 percent completion rate with a small socioeconomic gap, differences by home advantage in Vietnam at the secondary level might require more sophisticated measurements, considering access to learning opportunities and resources.

5.2 Effects of life experience on students' creativity

Our data indicate that there are strong connections between experiential activities both within and outside the school environment and adolescents' creativity. In particular, experiences such as doing homework, reading for pleasure and academic purposes, participating in extracurricular activities, shared activities with parents are the top predictors of students' creative ability. Whereas, faint correlation can be seen in the code of attending extra tutorial classes, attending skills classes, and holding a leadership position. Noteworthily, there is no connection between academic achievement and creativity ability.

The analyzed results that doing homework and reading are significantly associated with adolescent's creativity skills are found to match those observed in earlier studies (Van Voorhis 2001;

North and Pillay 2002; VanDeGrift 2015; Xue et al. 2016; Mourgues et al. 2014; Stuart J. Ritchie et al. 2015; Wang 2012). There are several possible explanations for this. First, when doing homework independently, students are free to discover and generate new ideas as well as find their own solutions to solve problems. The sense of ownership towards their work can promote the creation of new ideas and solutions (VanDeGrift 2015), which is why this activity is encouraging and facilitating learning (North and Pillay 2002). In addition, there are take-home assignments and projects that request learners to cooperate with others and therefore learn from each other (Xue et al. 2016; Hallam 2006). Reading also can help improve adolescents' creativity by facilitating creative thinking (Mourgues et al. 2014; Stuart J Ritchie et al. 2013) since students could encounter many novel concepts and ideas that form the basis of the development of their cognitive skills.

The role of extra tutorial classes being insignificant compared to independent studying and reading activities in our study is interesting to examine. It could be due to the fact that doing homework and reading enable deeper levels of knowledge processing to take place, from which learners expand their learning and enrich their knowledge (Sadoski et al. 1990). Whereas extra tuition, especially in the East Asian context, is primarily exam-oriented where self-directed thinking is often not encouraged (Kim 2007). On the same token, much consistent with other research, our analyses show that academic performance does not significantly relate to creative thinking skills of students (Gralewski and Karwowski 2012; Vijetha and Jangaiah 2010). The results might be even more applicable in education systems such as Vietnam's where assessment is still heavily knowledge-based without examining learners' perception and thinking skills. This finding is noteworthy since private tutoring for examination purposes has become very popular in Vietnam with the lack of control for instructional quality and consistent research findings of educational benefits of after-school and exam-oriented tuition to sustainable cognitive and non-cognitive skills formation in students.

Regarding the significant effect of parental interactions, our results confirm those in previous literature that children whose parents treat them with respect, have confidence about their capability hence giving them autonomy and freedom are more likely to develop good creative thinking skills (Miller and Gerard 1979). Regular discussion and exchanging viewpoints with parents could serve as a useful source of input which enriches children's knowledge and understanding as well as stimulates their self-direction of thinking. Similarly, as pointed out in our study and past research, those who pursue challenging activities consistently and passionately tend to be more initiative and creative in leading their life (Milgram and Hong 1999). For example, creative thinking is a primary skill to be developed together with leadership ability as leaders often face issues that require thorough thinking and consideration, flexibility, originality, and creativity in the solutions (Guo et al. 2016). However, participation in such activities has to be one's voluntary decision but not upon parents' request. Otherwise, the effects could be reversed to hinder the creativity skills development of children (Robinson et al. 2013).

5.3 *Digital experiences and Creativity*

The results from this study found that digital experiences are positively correlated with students' creativity skills and are even more influential than life experiences. This has also been evident in previous studies which conclude that more frequent use of digital devices and better technological skills are linked with a higher level of creativity (Ala-Mutka et al. 2008; Bush and Hall 2011; Anastasiades 2017; Casimaty and Henderson 2016). It is explainable that having access to the digital world broadens their knowledge and understanding particularly domain-relevant knowledge which requires constant updates and innovations (Dewett 2003). Digital experiences are found to strongly affect innovation and organization competence because they stimulate the formulation of new ideas, or the processing of common ideas in innovative ways and convert ideas into products or processes, which are considered a dimension of the creativity (Van Laar et al. 2017). It is worth noting that ICT skills examined in our study are strongly focused on learners' ability to make use of digital media for educational purposes. There would be no benefits to creative thinking skills if children only use

electronic devices to socialize with friends or entertainment. The findings, therefore, propose important implications about raising digital proficiency as a basis for skills acquisition in youths.

6. Limitations and Further Research

Like any scientific research, this study is not without limitations. The first and most notable issue concerns our applied measures as all data are based on students' self-reports. Although self-rated creativity and creative self-efficacy seem to be a strong predictor of individual creative ability, other measures need to be applied in replication of this study, including product-oriented measurements (Amabile 2018). From the theoretical perspective, separation of effects on creative self-efficacy, self-rated creativity, and divergent thinking skills should be made more transparent since these are distinct concepts concerning creativity whose studying methods are of critical importance (Beghetto and Karwowski 2017). Moreover, the scale for measuring creativity adopted in the study, despite being reliable, only consists of five items. Further elaboration and expansion of items are recommended in subsequent studies (Beghetto 2006). The second caution is connected with the design of this study which only implies a correlational relationship. The observed effects should not be interpreted as causality.

7. Acknowledgement

This research is supported by the Vietnam National Science and Technology Program on Education Sciences, Grant number KHGD/16-20.ĐT.041.

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