DIGITAL GAME ADDICTION, AGGRESSION AND LONELINESS AMONG ADOLESCENTS

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Abstract

The primary purpose of this study was to investigate digital game addiction, aggression and loneliness among adolescents. In this study, a total of 715 adolescents (Grade Ten students, Grade Eleven students, university students and out-of-school adolescents) participated and quantitative research design was used. Regarding digital game addiction, the results indicated that male adolescents had higher total digital game addiction and all subscales of digital game addiction than female adolescents. Results revealed that adolescents who were 17-18 years old had higher than those who were 15-16 and 19-21 years old in total digital game addiction, tolerance, withdrawal and problems, while adolescents who were 19-21 years old had higher than those who were 15-16 years old in salience and problems. Results indicated that university students were significantly higher in salience and problems than Grade Ten and Grade Eleven students. Results revealed that there were significant differences in total digital game addiction and all subscales of digital game addiction by time spent playing digital games per day. Regarding aggression, results indicated that male adolescents had higher physical aggression than female adolescents whereas female adolescents had higher emotion and hostility than male adolescents. Results showed that there were no significant differences by age and education level in total aggression and all subscales of aggression. Results found that there was significant difference in physical aggression by time spent playing digital games per day. Regarding loneliness, results indicated that there were no significant differences of loneliness by gender and education level. Findings revealed that adolescents who were 19-21 years old had higher loneliness than those who were 15-16 years old. In addition, results indicated that there was significant difference in loneliness by time spent playing digital games per day. Furthermore, there were significant differences in aggression and loneliness by digital game addiction levels. Finally, adolescents' digital game addiction was positively correlated with aggression and loneliness.

Keywords: Digital Game Addiction, Aggression, Loneliness, Adolescents, University Students, Out-of-school Adolescents

Introduction

In the modern world, the internet, mobile phones and digital games are now a part of teenagers and adolescents' lives. Digital games provide opportunities for individuals by serving as a leisure time activity, offering fun, competition and social interaction (Gentile et al., 2011). With improvement of new computer software and hardware, digital games have become more realistic and remarkable. Nowadays, people prefer to digital games instead of face-to-face communication.

In the past, games played in outdoor places (playgrounds, streets, etc.) in interaction with friends, whereas today, the games are started to be played with people in virtual and indoor environment along with the development of technology, computer and internet. Moreover, it implies that while playing digital games has some positive good effects on the player but on the other hand, it also has negative effects on the player, especially addictive digital game playing (Xue-min, 2009).

The main issue with playing digital games is that the digital games are designed for human minds and choices when someone start playing digital game, they enjoy it during playing

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and they feel the level of satisfaction and on every winning or reaching some level of achievement it makes them more attracted towards playing more digital games and to win it again and again with the passage of time this type of behavior takes them to abnormality and to addiction (Anderson & Bushman, 2002).

Digital game addictions rapidly spreading around the world will also widespread among adolescents in Myanmar. The latest China Internet Network Information Center's (CNNIC) report revealed that the growth rate of digital game has reached 9.6% and adolescents are the main user group. In general, adolescents are more likely to show signs of digital game addiction than older age groups. Adolescents' attractions to the digital games cause many mental, physical and social problems for them. Furthermore, preventing or controlling digital game addiction is of particular importance during adolescence because previous research has indicated that all addictions and dependencies identified in adults commonly start in adolescence (Wagner & Anthony, 2002).

In addition, most of the top-selling digital games contain violent elements and harmful contents which can result negative social effects especially on adolescents' minds. By constantly rewarding players for violent actions, automated aggressive knowledge structures and emotional desensitization to violent stimuli are learned. The more these aggressive actions are rehearsed, the greater their impact on hostile emotion and aggressive thinking (Carnagey & Anderson, 2005). On the other hand, the longer duration of gaming, the poorer social competence (Gentile, 2004). Therefore, loneliness has been found as one of the risk factors of digital game addiction among gamers.

Gender, age, education level and time spent playing digital games were identified as possible risk factors of digital game addiction, aggression and loneliness (Wood et al., 2007; Xu, Turel, & Yuan, 2012). Previous studies also highlighted the need to explore these demographic factors to examine the differences of adolescents' digital game addiction, aggression and loneliness. Moreover, the American Psychiatric Association has encouraged further more research on the impact of digital game addiction on behavioral and social problems (e.g., aggression, loneliness). In Myanmar, very few studies have been focused on investigating this issue among adolescents in our country. Therefore, this study aimed at investigating how digital game addiction relates to aggression and loneliness.

Aim and Objectives

The main aim of this study was to investigate digital game addiction, aggression and loneliness among adolescents. The specific objectives were:

(1) To examine the levels of digital game addiction, aggression and loneliness of adolescents
(2) To investigate adolescents' digital game addiction, aggression and loneliness by gender, age, education level and duration of time spent playing digital games
(3) To explore adolescents' aggression and loneliness by digital game addiction levels
(4) To examine the relationship of digital game addiction, aggression and loneliness among adolescents

Definitions of Key Terms

Digital game addiction. Digital game addiction which is a condition that stems from the steadily growing passion for digital games and their excessive and uncontrolled usage among adolescents and young people (Irmak & Erdogan, 2015).

Aggression. Aggression is defined as any behavior directed toward another individual carried out with the proximate intent to cause harm (Anderson & Bushman, 2002).

Loneliness. Loneliness is defined as an increase in the level of anxiety, anger towards his/her environment, sadness and feeling of being different from other people, and not being able to meet the need for intimacy in the community or in private relationships (Esen, 2010).

Adolescents. The periods of adolescence can generally be divided into early adolescence (from the ages of 10 to 13 years), middle adolescence (from the ages of 14 to 17 years) and late adolescence (from the ages of 18 to 24 years) (Metzger, 2006).

Out-of-school adolescents. The out-of-school adolescents in this study are defined as adolescents who are definitively out of school, meaning that they are not enrolled in secondary or any other level of education.

Review of Related Literature

Digital Game Addiction

Digital game addiction is displayed by several types of behavior; obsessing on a game, demanding spending time on games daily, increasing desire, and anger from being obstructed. These behavioral types affect routine life and physical and mental health (Gentile et al., 2011). Digital gaming addiction has been classified and explained in numerous ways. There are two theories which have applied to digital games, the first one is “the behaviorist theory” and the second one is “the uses and gratifications theory”. Thus, the components model of addiction of the British psychologist Mark Griffiths is the leading framework used in the research of addiction to digital games. Griffiths (2005) has operationally defined addictive behavior as any behavior that features the six core components of addiction (i.e., salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse).

Aggression

Today digital games are characterized by enhanced realism in graphics and sounds, combined with even more extreme violent action. The players start simulating aggressive behavior as they try to imitate what they have seen on screen. Adaptation of such aggressive behavior affects their real life (Bushman & Anderson, 2009). The General Aggression Model (GAM), a synthesis of several social-cognitive, neo associative theories and Bandura’s (1978) social learning theory (SLT) of aggression, which predicts that aggressive behaviors can be reinforced either through direct experience or vicarious observation of aggressive acts being rewarded.

Loneliness

Game addiction may lower adolescents’ motivation for communicating with other people and consequently impose negative effects on their social relationships (Kuss & Griffiths, 2012). People cope with their emotional distress by playing digital games, but the excessive use of digital games for a long time may separate individuals from real-life relationships and become

loneliness (Wang et al., 2019). This study will explore the relationship of digital game addiction and loneliness through the perspective of attachment theory. Attachment theory is a developmental framework that emphasizes the role of early experience in influencing the expectations, beliefs, and behaviors of an individual's responsiveness and trustworthiness of others (Fraley, 2002).

Method

Research Design

The design used in this study was quantitative research design.

Participants of the Study

Adolescents (Grade Ten students, Grade Eleven students, university students and out-of-school adolescents) were selected from Mon State. A total of 715 adolescents (50.8% male and 49.2% female; M_{age} = 17.66 years old, SD_{age} = 2.05 years old) participated in this study (see Table 1).

Table 1 Characteristics of Participants

Education Level	Gender		Total
	Male	Female	
Grade Ten Students	109	99	208
Grade Eleven Students	79	106	185
University Students	81	83	164
Out-of-school Adolescents	93	65	158
Total	**362**	**353**	**715**

Measures of the Study

To assess adolescents' digital game addiction, Aggression and loneliness, Game Addiction Scale (Lemmens et al., 2009), Aggression Questionnaire (Faris et al., 2016) and UCLA (University of California, Los Angeles) Loneliness Scale (Russell, 1996) were used in this study. The Cronbach's alpha of digital game addiction, aggression and loneliness were 0.922, 0.843 and 0.810 that indicated high internal consistency.

Instrumentation

All the measures used in this study were adapted to Myanmar language version. After preparing the measuring scales, expert review was conducted for face validity and content validity by seven experts who have special knowledge in the field of educational psychology. Next, revisions in item length, the wording of items, and content were made during preliminary administrations of the self-reported survey questionnaire. And then, pilot study was done with a sample of 50 adolescents to assess whether the wording of items, statements and instructions were appropriate and relevant to adolescents. Then, the wording and phrases of some items were modified since they were inappropriate with adolescents' understanding level.

Results

Digital Game Addiction Level of Adolescents

Based on descriptive analyses of digital game addiction, 16.8% of adolescents with scores one standard deviation above the sample mean were considered high group; 64.6% of adolescents with scores between (+1) and (-1) standard deviation from the sample mean were grouped into moderate group; and the remaining adolescents of 18.6% who scored one standard deviation lower than the sample mean were identified as low group (see Figure 1).

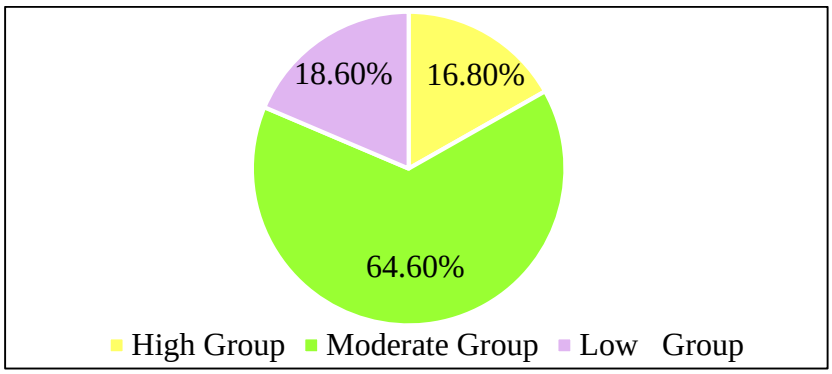

Figure 1 Three Different Groups for Digital Game Addiction of Adolescents

Comparison of Digital Game Addiction by Gender

The results of independent samples *t*-test stated that male adolescents had higher digital game addiction than female adolescents (see Table 2).

Table 2 Means, Standard Deviations and Independent Samples *t*-test Results of Digital Game Addiction by Gender

Variables	Gender	*N*	Mean	*SD*	*t*	*df*	*p*
Salience	Male	362	7.64	2.54	7.975***	713	.000
	Female	353	6.14	2.50			
Tolerance	Male	362	7.63	2.70	5.851***	713	.000
	Female	353	6.42	2.83			
Mood modification	Male	362	9.32	3.09	5.702***	713	.000
	Female	353	7.95	3.36			
Relapse	Male	362	7.28	2.53	5.031***	709.283	.000
	Female	353	6.31	2.65			
Withdrawal	Male	362	7.10	3.08	5.738***	713	.000
	Female	353	5.82	2.88			
Conflict	Male	362	7.05	2.69	6.260***	713	.000
	Female	353	5.79	2.69			
Problems	Male	362	7.35	2.69	8.310***	713	.000
	Female	353	5.71	2.59			
Total Digital Game Addiction	Male	362	53.38	14.16	8.305***	702.933	.000
	Female	353	44.13	15.57			

Note. ***The mean difference is significant at the 0.001 level.

Comparison of Digital Game Addiction by Age

ANOVA results showed that there were significant differences of adolescents' total digital game addiction, salience, tolerance, withdrawal and problems by age (see Table 3).

Table 3 Means, Standard Deviations and ANOVA Results of Digital Game Addiction by Age

Variables	Age	*N*	Mean	*SD*	*F*	*p*
Salience	15-16 years	238	6.55	2.66	3.264*	.039
	17-18 years	246	7.03	2.70		
	19-21 years	231	7.13	2.50		
Tolerance	15-16 years	238	6.62	2.82	3.751*	.024
	17-18 years	246	7.26	2.87		
	19-21 years	231	7.20	2.77		
Mood modification	15-16 years	238	8.45	3.37	1.087	.338
	17-18 years	246	8.88	3.36		
	19-21 years	231	8.59	3.16		
Relapse	15-16 years	238	6.81	2.78	0.294	.746
	17-18 years	246	6.89	2.60		
	19-21 years	231	6.70	2.54		
Withdrawal	15-16 years	238	6.05	2.91	6.515**	.002
	17-18 years	246	7.02	3.06		
	19-21 years	231	6.32	3.11		
Conflict	15-16 years	238	6.12	2.80	2.698	.068
	17-18 years	246	6.70	2.75		
	19-21 years	231	6.47	2.72		
Problems	15-16 years	238	6.02	2.77	6.379**	.002
	17-18 years	246	6.81	2.63		
	19-21 years	231	6.78	2.84		
Total Digital Game Addiction	15-16 years	238	46.62	15.70	4.050*	.018
	17-18 years	246	50.58	15.74		
	19-21 years	231	49.20	15.03		

Note. *The mean difference is significant at the 0.05 level.

**The mean difference is significant at the 0.01 level.

The results of Tukey HSD tests indicated that adolescents who were 17-18 years old had higher tolerance, withdrawal, problems and total digital game addiction than those who were 15-16 years old at 0.05 and 0.01 levels and had higher withdrawal than those who were 19-21 years old at 0.05 level. Adolescents who were 19-21 years old had higher salience and problems than those who were 15-16 years old at 0.05 and 0.01 levels.

Comparison of Digital Game Addiction by Education Level

ANOVA results showed that there were significant differences for salience and problems by education level (see Table 4).

Table 4 Means, Standard Deviations and ANOVA Results of Digital Game Addiction by Education Level

Variables	Education Level	*N*	Mean	*SD*	*F*	*p*
Salience	Grade Ten	208	6.55	2.55	5.533**	.001
	Grade Eleven	185	6.58	2.68		
	University Students	164	7.52	2.47		
	Out-of-school Adolescents	158	7.08	2.73		
Tolerance	Grade Ten	208	6.62	2.88	2.583	.052
	Grade Eleven	185	7.11	2.97		
	University Students	164	7.41	2.53		
	Out-of-school Adolescents	158	7.08	2.84		
Mood modification	Grade Ten	208	8.28	3.23	2.427	.064
	Grade Eleven	185	8.94	3.49		
	University Students	164	9.02	2.98		
	Out-of-school Adolescents	158	8.38	3.43		
Relapse	Grade Ten	208	7.00	2.83	1.414	.238
	Grade Eleven	185	6.59	2.54		
	University Students	164	6.99	2.33		
	Out-of-school Adolescents	158	6.58	2.76		
Withdrawal	Grade Ten	208	6.25	2.98	0.629	.596
	Grade Eleven	185	6.46	3.07		
	University Students	164	6.58	2.90		
	Out-of-school Adolescents	158	6.66	3.27		
Conflict	Grade Ten	208	6.33	2.92	1.742	.157
	Grade Eleven	185	6.39	2.69		
	University Students	164	6.84	2.69		
	Out-of-school Adolescents	158	6.18	2.67		
Problems	Grade Ten	208	6.14	2.79	3.105*	.026
	Grade Eleven	185	6.45	2.67		
	University Students	164	6.98	2.64		
	Out-of-school Adolescents	158	6.71	2.91		
Total Digital Game Addiction	Grade Ten	208	47.18	15.93	2.257	.081
	Grade Eleven	185	48.53	16.01		
	University Students	164	51.35	13.59		
	Out-of-school Adolescents	158	48.68	16.28		

Note. *The mean difference is significant at the 0.05 level.

**The mean difference is significant at the 0.01 level.

The results of Tukey HSD multiple comparison indicated that in adolescents' salience, university students had higher than Grade Ten and Grade Eleven students at 0.01 level. And, university students had higher in problems subscale than Grade Ten students at 0.05 level.

Comparison of Digital Game Addiction by Time Spent Playing Digital Games Per Day

ANOVA results revealed that there were significant differences in adolescents' total digital game addiction and all subscales of digital game addiction by time spent playing digital games per day (see Table 5).

Table 5 Means, Standard Deviations and ANOVA Results of Digital Game Addiction by Time Spent Playing Digital Games Per Day

Variables	Time Spent Playing Digital Games Per Day	*N*	Mean	*SD*	*F*	*p*
Salience	None	115	3.91	1.68	138.960***	.000
	Less than 1 hour	239	6.47	1.94		
	1-3 hours	235	7.58	2.20		
	More than 4 hours	126	9.17	2.48		
Tolerance	None	115	3.71	1.29	137.440***	.000
	Less than 1 hour	239	6.70	2.32		
	1-3 hours	235	7.73	2.36		
	More than 4 hours	126	9.37	2.61		
Mood modification	None	115	4.84	2.54	106.433***	.000
	Less than 1 hour	239	8.36	2.72		
	1-3 hours	235	9.84	2.82		
	More than 4 hours	126	10.40	2.85		
Relapse	None	115	4.93	3.03	28.830***	.000
	Less than 1 hour	239	6.93	2.44		
	1-3 hours	235	7.07	2.30		
	More than 4 hours	126	7.75	2.41		
Withdrawal	None	115	3.96	2.08	57.331***	.000
	Less than 1 hour	239	6.13	2.77		
	1-3 hours	235	7.02	2.93		
	More than 4 hours	126	8.40	2.86		
Conflict	None	115	4.09	2.29	54.816***	.000
	Less than 1 hour	239	6.19	2.51		
	1-3 hours	235	7.00	2.64		
	More than 4 hours	126	7.98	2.34		
Problems	None	115	4.05	1.98	76.102***	.000
	Less than 1 hour	239	6.05	2.54		
	1-3 hours	235	7.26	2.42		
	More than 4 hours	126	8.40	2.50		
Total Digital Game Addiction	None	115	29.50	11.83	157.980***	.000
	Less than 1 hour	239	46.84	11.68		
	1-3 hours	235	53.50	12.44		
	More than 4 hours	126	61.48	12.39		

Note. ***The mean difference is significant at the 0.001 level.

Then, the results of Tukey HSD test showed that adolescents who spent playing digital games more than 4 hours had the highest total digital game addiction and all subscales of digital game addiction while adolescents who didn't play digital games had the lowest at 0.05, 0.01 and 0.001 levels.

Comparison of Aggression by Gender

Results of independent samples *t*-test pointed out that male adolescents had more physical aggression than female adolescents. Thus, female adolescents were significantly higher in emotion and hostility than male adolescents (see Table 6).

Table 6 Means, Standard Deviations and Independent Samples *t*-test Results of Aggression by Gender

Variables	Gender	*N*	Mean	*SD*	*t*	*df*	*p*
Physical Aggression	Male	362	20.48	6.86	3.874***	713	.000
	Female	353	18.52	6.60			
Verbal Aggression	Male	362	13.15	3.96	0.236	713	.813
	Female	353	13.08	4.27			
Emotion	Male	362	16.69	5.30	-2.059*	713	.040
	Female	353	17.53	5.71			
Hostility	Male	362	21.76	6.49	-2.308*	713	.021
	Female	353	22.91	6.77			
Total Aggression	Male	362	72.07	16.58	0.025	713	.980
	Female	353	72.04	18.07			

Note. *The mean difference is significant at the 0.05 level.
***The mean difference is significant at the 0.001 level.

Comparison of Aggression by Age

ANOVA results showed that there were no significant age differences of adolescents' total aggression and all subscales of aggression (see Table 7).

Table 7 Means, Standard Deviations and ANOVA Results of Aggression by Age

Variables	Age	*N*	Mean	*SD*	*F*	*p*
Physical Aggression	15-16 years	238	19.03	7.09	2.534	.080
	17-18 years	246	20.30	6.50		
	19-21 years	231	19.17	6.76		
Verbal Aggression	15-16 years	238	12.87	4.17	0.630	.533
	17-18 years	246	13.26	3.97		
	19-21 years	231	13.21	4.20		
Emotion	15-16 years	238	16.73	5.68	1.128	.324
	17-18 years	246	17.48	5.32		
	19-21 years	231	17.09	5.54		
Hostility	15-16 years	238	21.97	6.91	0.529	.590
	17-18 years	246	22.53	6.55		
	19-21 years	231	22.48	6.49		
Total Aggression	15-16 years	238	70.60	17.99	1.792	.167
	17-18 years	246	73.57	15.90		
	19-21 years	231	71.95	18.00		

Comparison of Aggression by Education Level

ANOVA results indicated that there were no significant differences of total aggression and all subscales of aggression by education level (see Table 8).

Table 8 Means, Standard Deviations and ANOVA Results of Aggression by Education Level

Variables	Education Level	*N*	Mean	*SD*	*F*	*p*
Physical Aggression	Grade Ten	208	19.25	7.26	0.557	.643
	Grade Eleven	185	19.74	6.68		
	University Students	164	19.16	6.23		
	Out-of-school Adolescents	158	19.97	6.89		

Variables	Education Level	*N*	Mean	*SD*	*F*	*p*
Verbal Aggression	Grade Ten	208	13.05	4.22	1.416	.237
	Grade Eleven	185	12.87	3.98		
	University Students	164	12.92	3.95		
	Out-of-school Adolescents	158	13.70	4.26		
Emotion	Grade Ten	208	16.71	5.70	1.099	.349
	Grade Eleven	185	16.98	5.31		
	University Students	164	17.12	5.32		
	Out-of-school Adolescents	158	17.75	5.71		
Hostility	Grade Ten	208	21.77	6.53	1.076	.359
	Grade Eleven	185	22.88	6.83		
	University Students	164	22.12	6.42		
	Out-of-school Adolescents	158	22.63	6.83		
Total Aggression	Grade Ten	208	70.77	17.83	1.203	.308
	Grade Eleven	185	72.46	16.93		
	University Students	164	71.32	16.27		
	Out-of-school Adolescents	158	74.04	18.10		

Comparison of Aggression by Time Spent Playing Digital Games Per Day

ANOVA results revealed that there was significant difference in physical aggression by time spent playing digital games per day (see Table 9).

Table 9 Means, Standard Deviations and ANOVA Results of Aggression by Time Spent Playing Digital Games Per Day

Variables	Time Spent Playing Digital Games Per Day	*N*	Mean	*SD*	*F*	*p*
Physical Aggression	None	115	18.01	7.15	5.318**	.001
	Less than 1 hour	239	18.98	6.72		
	1-3 hours	235	19.88	6.50		
	More than 4 hours	126	21.21	6.81		
Verbal Aggression	None	115	13.10	4.27	0.010	.999
	Less than 1 hour	239	13.09	4.22		
	1-3 hours	235	13.14	3.82		
	More than 4 hours	126	13.15	4.31		
Emotion	None	115	16.88	5.05	0.378	.769
	Less than 1 hour	239	16.88	5.67		
	1-3 hours	235	17.32	5.63		
	More than 4 hours	126	17.33	5.44		
Hostility	None	115	21.53	7.04	0.963	.410
	Less than 1 hour	239	22.72	6.72		
	1-3 hours	235	22.16	6.30		
	More than 4 hours	126	22.63	6.79		
Total Aggression	None	115	69.51	18.04	1.641	.178
	Less than 1 hour	239	71.67	17.99		
	1-3 hours	235	72.49	16.50		
	More than 4 hours	126	74.33	16.68		

Note. **The mean difference is significant at the 0.01 level.

The results of Tukey HSD test described that adolescents who spent playing digital games more than 4 hours had higher physical aggression than those who did not spend at 0.01 level and spent playing digital games less than 1 hour at 0.05 level.

Comparison of Loneliness by Gender

The result of independent samples *t*-test indicated that there was no significant difference in adolescents' loneliness by gender (see Table 10).

Table 10 Means, Standard Deviations and Independent Samples *t*-test Result of Loneliness by Gender

Variable	Gender	*N*	Mean	*SD*	*t*	*df*	*p*
Loneliness	Male	362	22.04	10.17	1.293	713	.196
	Female	353	21.07	9.84			

Comparison of Loneliness by Age

ANOVA result indicated that there was significant age difference for loneliness (see Table 11).

Table 11 Means, Standard Deviations and ANOVA Result of Loneliness by Age

Variable	Age	*N*	Mean	*SD*	*F*	*p*
Loneliness	15-16 years	238	20.19	9.62	3.404*	.034
	17-18 years	246	22.11	9.99		
	19-21 years	231	22.39	10.32		

Note. *The mean difference is significant at the 0.05 level.

The result of Tukey HSD test indicated that adolescents who were 19-21 years old had higher loneliness than those who were 15-16 years old at 0.05 level.

Comparison of Loneliness by Education Level

ANOVA result showed that no significant difference was found across education level (see Table 12).

Table 12 Means, Standard Deviations and ANOVA Result of Loneliness by Education Level

Variable	Education Level	*N*	Mean	*SD*	*F*	*p*
Loneliness	Grade Ten	208	20.35	9.46	2.196	.087
	Grade Eleven	185	21.31	10.05		
	University Students	164	22.92	11.03		
	Out-of-school Adolescents	158	22.03	9.43		

Comparison of Loneliness by Time Spent Playing Digital Games Per Day

ANOVA result indicated that there was significant difference for loneliness by time spent playing digital games per day (see Table 13).

Table 13 Means, Standard Deviations and ANOVA Result of Loneliness by Time Spent Playing Digital Games Per Day

Variable	Time Spent Playing Digital Games Per Day	*N*	Mean	*SD*	*F*	*p*
Loneliness	None	115	19.91	9.07	3.445*	.016
	Less than 1 hour	239	20.67	9.59		
	1-3 hours	235	22.33	10.31		
	More than 4 hours	126	23.31	10.74		

Note. *The mean difference is significant at the 0.05 level.

The result of Tukey HSD test showed that adolescents who spent playing digital games more than 4 hours per day had higher loneliness than those who didn't play digital games at 0.05 level.

Comparison of Aggression by Digital Game Addiction Levels

ANOVA results revealed that there were significant differences in total aggression and all subscales of aggression by digital game addiction levels (see Table 14).

Table 14 Means, Standard Deviations and ANOVA Results of Aggression by Digital Game Addiction Levels

Variables	Digital Game Addiction Levels	*N*	Mean	*SD*	*F*	*p*
Physical Aggression	Low Group	133	16.72	7.13	28.297***	.000
	Moderate Group	462	19.43	6.19		
	High Group	120	22.92	7.22		
Verbal Aggression	Low Group	133	12.57	4.21	6.562**	.002
	Moderate Group	462	12.97	4.00		
	High Group	120	14.30	4.24		
Emotion	Low Group	133	16.08	5.06	7.818***	.000
	Moderate Group	462	16.98	5.43		
	High Group	120	18.73	6.01		
Hostility	Low Group	133	21.22	7.25	10.276***	.000
	Moderate Group	462	22.03	6.50		
	High Group	120	24.71	5.99		
Total Aggression	Low Group	133	67.00	17.90	23.112***	.000
	Moderate Group	462	71.40	16.62		
	High Group	120	80.66	16.27		

Note. **The mean difference is significant at the 0.01 level.
***The mean difference is significant at the 0.001 level.

The results of Tukey HSD test indicated that adolescents in moderate group of digital game addiction had higher physical aggression at 0.001 level and total aggression at 0.05 level than those in low group of digital game addiction. Adolescents in high group of digital game addiction had higher in total aggression at 0.001 level and all subscales of aggression at 0.01 and 0.001 levels than those in low and moderate group of digital game addiction.

Comparison of Loneliness by Digital Game Addiction Levels

ANOVA result revealed that there was significant difference in loneliness by digital game addiction levels (see Table 15).

Table 15 Means, Standard Deviations and ANOVA Result of Loneliness by Digital Game Addiction Levels

Variable	Digital Game Addiction Levels	*N*	Mean	*SD*	*F*	*p*
Loneliness	Low Group	133	18.49	9.35	10.780***	.000
	Moderate Group	462	21.76	9.89		
	High Group	120	24.19	10.39		

Note. ***The mean difference is significant at the 0.001 level.

The results of Tukey HSD test indicated that adolescents in moderate group of digital game addiction had higher loneliness than those in low group of digital game addiction at 0.01 level. Moreover, adolescents in high group of digital game addiction had higher loneliness than those in low at 0.001 level and moderate group of digital game addiction at 0.05 level.

Relationship of Digital Game Addiction, Aggression and Loneliness

To find out the relationship of digital game addiction, aggression and loneliness among adolescents, Pearson product-moment correlations were conducted (see Table 16).

Table 16 The Relationship of Digital Game Addiction, Aggression and Loneliness

Variables	(1) Digital Game Addiction	(2) Aggression	(3) Loneliness
(1) Digital Game Addiction	1	0.331**	0.250**
(2) Aggression		1	0.443**
(3) Loneliness			1

Note. **Correlation is significant at the 0.01 level (2-tailed).

The results indicated that digital game addiction was positively correlated with aggression and loneliness. Specifically, when digital game addiction increases, aggression will increase. When digital game addiction increases, loneliness will also increase.

Discussion

Regarding digital game addiction, findings revealed that mood modification was the highest in all subscales of digital game addiction of adolescents. Moreover, results indicated that male adolescents had higher digital game addiction than female adolescents. This result consistent with Xu et al. (2012) but inconsistent with Festl et al. (2013). Males have a stronger motivation to play and pick up more positive thoughts from playing digital games (Horzum, 2011). Another reason is parents exert more control over internet and game use of their daughters than of their sons in Myanmar.

The results indicated that adolescents who were 17-18 years old had the highest total digital game addiction, tolerance, withdrawal and problems. The findings were consistent with previous studies of Lemola et al. (2011) and Walther et al. (2012). And then, adolescents who were 19-21 years old had higher salience and problems than those who were 15-16 years old. This result was consistent with Horzum (2011). Adolescents need more and more game time immersion to feel satisfied and get bad feelings after playing for a long time. Thus, results

showed that university students were significantly higher than Grade Ten and Grade Eleven students. These findings were consistent with previous studies of Anand (2007) and Goldag (2015) but different result with Thomas & Martin (2010). Kandell (1998) noted that university students were more vulnerable to use digital games in comparison to any other groups because of their flexible time schedules, being away from home and so on. Next, results revealed that adolescents who spent playing digital games more than 4 hours had the highest digital game addiction. These findings confirm that there was a positive correlation between the time spent on games and digital gaming addiction (Goldag, 2015).

Regarding aggression, the results revealed that hostility was the highest in all subscales of aggression of adolescents. This result was consistent with previous studies of Anderson et al. (2010) and Eastin (2007). The "father of adolescence", Hall described the age of adolescence as the time period of "Storm and Stress". The results showed that male adolescents had higher physical aggression than female adolescents. And, female adolescents had higher emotion and hostility than male adolescents. These results were consistent with previous studies of Lemmens et al. (2009) and Anderson et al. (2010). It can be seen that males are more likely to engage in direct physical aggression and violence than females according to their nature. On the other hand, females show greater emotional expressivity than male adolescents.

The results indicated that there were no significant differences by age and education level in total aggression and all subscales of aggression. These result were consistent with previous studies of Lahey et al. (2000) and Wyckoff (2016). It could be assumed that adolescents' aggression does not depend on age and education level in the modern era. Next, results revealed that adolescents who spent playing digital games more than 4 hours had higher physical aggression than those who did not spend and spent playing digital games less than 1 hour. Adolescents that play violent digital games show more aggressive behavior and involve themselves in fights with their peers after playing games for a long time (Gentile et al., 2011).

Regarding loneliness, the result indicated that there was no significant gender difference in loneliness. This finding was consistent with previous studies of AI-Kfaween (2010) and Weiss (1973). The result indicated that adolescents who were 19-21 years old had higher loneliness than those who were 15-16 years old. The result was consistent with previous studies of Lemmens et al. (2009) and Wang et al. (2019). Piscopo (2015) stated that late adolescents (19-21 years old) were at higher risk for suicidal thoughts and attempts than other age groups because of depression and loneliness. The result showed that there was no significant difference by education level in loneliness. This finding was consistent with previous studies of Certel et al. (2016) and Kılıç (2014). Next, results revealed that adolescents who spent playing digital games more than 4 hours had the highest loneliness. The findings confirmed that there was a positive correlation between the time spent on games and loneliness (Lemmens et al., 2009). Overplaying digital games adversely affects the socialization process of an individual and pushes him to loneliness.

Finally, findings of this study revealed that adolescents' digital game addiction was positively correlated with aggression. This result was consistent with previous studies of Anderson et al. (2010) and Lemmens et al. (2009). Getting reward and encouragement for doing violent tasks in game will encourage and motivate the young generation to do the same thing in real world. In addition, adolescents' digital game addiction was positively correlated with loneliness. This result was consistent with previous studies of Chen et al. (2018) and Lemmens et

al. (2009). The overuse of digital games can result in isolation from social activities and feel loneliness.

Limitations and Future Research

Participants in this study were only from Mon State since all schools and universities are closed because of COVID-19. Future studies need to collect data from different regions and states of Myanmar for the generalization of the results. Moreover, more research is required to investigate longitudinal studies of adolescents' digital game addiction, aggression and loneliness.

Conclusion

Digital game addiction is now officially a new debatable issue that has emerged as a consequence of the development and increasing popularity of digital games and online technologies during the 21st century. This study was done to fulfill the need and develop awareness in the society about digital game addiction, aggression and loneliness among adolescents. The issues for awareness and ethical responsibilities have been highlighted to safe our next generation from the negative effects of digital game addiction. Moreover, by understanding the consequences of digital game addiction, better prevention and intervention techniques of digital game addiction can be developed.

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