Behavioral, social and emotional impact of online learning on children with autism spectrum disorder

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1.Literature review

According to the Centers for Disease Control and Prevention (CDC, 2020) and based on data from the Autism and Developmental Disabilities Monitoring Network (ADDM), in 2016 approximately 1 in 54 children were projected to have an ASD, which constitutes an almost threefold increase from the levels observed in the year 2000 (1 in 150 children). Another less conservative estimate of the prevalence of ASD found that, in 2016, for every 36 children there was 1 child that developed an ASD (Zablotsky, Black & Blumberg, 2017). Autistic spectrum disorders are found across different races, ethnicities and levels of socioeconomic status, and they are over four times more likely to manifest in boys than in girls (Christensen et al., 2016; Sharma, Gonda & Tarazi, 2018). The World Health Organization states that in several countries which have low-income and middle-income conditions the prevalence of ASD is as of yet not known (WHO, 2019). Individuals with ASD have considerable health needs which necessitate the use of a diverse array of services, like healthcare, health promotion and rehabilitation, as well as cooperation of healthcare services with educational, work and social services. Interventions that are directed towards individuals with ASD should be coupled with wider measures which help them to better adjust to their environment, rendering their social and physical contexts as well as the attitudes of others, more amenable to them (WHO, 2019). Using computers and other technological devices through the internet has brought on positive changes in the education of children and adults with ASD. The difficulties that children and adults with ASD face in social interaction and language expression with individuals with typical development can be ameliorated with the use of computers (Bölte et al., 2010), while computers also afford novel non-traditional opportunities for interaction, socialization, vocation and education (Grynszpan et al., 2014).

Computer-based educational and training interventions are custom-designed to assist individuals with ASD and have been receiving much attention by the educational and scientific communities (Bölte, 2004). Computer-based educational programs can further be utilized to promote skills that related to emotional expression and facial recognition in people with ASD (Tanaka et al., 2010; Wainer & Ingersol, 2011). Bölte et al. (2010) have proposed that as technology advances, new tools and applications can become more effective and be more able to improve the life quality of children with ASD and their families.

Indeed, many children and adults with ASD have stressed that online learning and the use of technology is enjoyable and beneficial for them (Odom et al., 2015; Vasquez III et al., 2015); similarly, children with ASD like to play with computer games (Kapp, 2012; Kuo et al., 2013) and to generally use computers (Gillespie-Lynch et al., 2014; Valencia et al., 2019), especially as this takes place in a familiar and safe environment where they can interact with others, gain knowledge, and acquire skills (Bagatell, 2010; Benford & Standen, 2009; Gillespie-Lynch et al., 2014; Kapp, 2012; Tsiopela & Jimoyiannis, 2014).

Children with ASD learn more effectively if they explicitly know what they are expected to learn, if they are provided with straightforward stimuli, if they are afforded enough opportunity for practice, and if they receive adequate and effective feedback from teachers and other students (Sansosti et al., 2015). Nevertheless, the mere use of technological devices and applications that is not complemented with appropriate

educational techniques and approaches cannot be expected to lead to better learning outcomes (Twyman, 2015).

Soon after the internet was created and launched, a number of researchers and other commentators observed that the internet holds great promise and may be highly beneficial for individuals with ASD. For example, Murray and Lesser (1999) proposed that the internet is a new 'autism-compatible environment' (cited in Davidson, 2008, p. 801), and Singer (1999) stated that the internet may effect significant positive changes in the lives of children with ASD, allowing them to break out of their communicatory isolation similarly to what the sign language has been for deaf individuals.

As seen earlier, people with ASD face substantial problems with social interactions and with establishing mutual relationships (Dawson et al., 2004), and this can lead them to feelings -and a reality- of isolation (Boyd et al., 2015). Problems with socialization faced by individuals with ASD of all ages can be ameliorated with the use of educational and clinical online interventions (Gerhardt & Mayville, 2010, Reichow & Volkmar, 2010).

Some of the overall advantages that computer-based interventions can have for the socialization of individuals with ASD are improved understanding and mastery of communication (Benford & Standen, 2009; Burke et al., 2010) and the opportunity to socially interact and to be supported by, as well as to support, people with kindred individuals regardless of their location in the world (Davidson, 2008; Jordan, 2010).

Many of the studies that assess the effectiveness of online learning programs/interventions in developing the social skills of people with ASD focus on the interaction between the user and a computer or device that uses assistive software with the aim to improve different types of skills (McCoy & Waller, 2009). Specifically, Cheng and Ye (2010) found, in a computer intervention with 3 boys with ASD aged 8-10 years, that their communication and relationship skills could be enhanced through the use of a "collaborative virtual learning environment" which involves "a 3D expressive avatar, an animated social situation, and verbal as well as text-communication" (p. 1068).

Additionally, Adams et al. (2019) report that asynchronous online learning can be used in such a way so as to smooth out a number of obstacles that learners with ASD themselves report as part of their learning experience. Asynchronous learning can help learners with ASD to reduce feelings of being socially overwhelmed or intimidated, and it can support them in managing their sensory sensitivities more effectively (Adams et al., 2019).

Given the above, research in online and computer learning interventions, in the form of software applications and collaborative games, designed to promote the social skills of children with ASD are promising and are showing positive results and are engaging and motivating for the users (Boyd et al., 2015). Further research in the field is however warranted, particularly in light of the fact that many of the studies in this field have used small sample sizes and often comprise pilot studies intended to be further researched.

Traditional face-to-face learning can be challenging for individuals with ASD, even as they are able to competently manage their responsibilities as students – it can have a negatively impact on their coping and academic performance (Gelbar, Smith & Reichow, 2014). Apart from problems with communication and a sense of belonging, students with ASD can experience increased levels of stress because of their sensory sensitivities and because of last-minute timetable changes and cancelations, among other reasons (Fabri & Andrews, 2016; Jansen et al., 2018). The stress levels of students with ASD can in this way be exacerbated, while other emotions like feeling isolated may increase and satisfaction with their education may decrease (Adams et al., 2019).

Online learning programs afford the learner more versatile features, and with asynchronous learning there are no temporal and spatial restrictions on where and when the learner will engage with the material. Additionally, in asynchronous online programs the learner is free to communicate with the academic faculty and other learners without pressure and haste, and has the potential to decrease the stress levels of students with ASD (Biggs & Tang, 2011).

Other learning computer-based applications that may offer social behavioral benefits for children with ASD can include interventions that involve interaction with a robot (Liu et al., 2008). In a study named “Aurora project”, Dautenhahn and Werry (2004) examined the ways in which a robot may be therapeutically utilized as a playmate for children with ASD in order to promote social interaction. The researchers reasoned that robots may be able to offer children with ASD an outlet for social interaction that is simple but that is demonstrated behaviorally, in a way that does not overwhelm or intimidate them (Dautenhahn & Werry, 2004).

2.Aims and research questions

The purpose of the study is to explore the attitudes of teachers towards the use of computers and online learning, whether they are confident, whether they have positive cognitions and feelings towards the use of computers and what is their self-efficacy. Additionally, the interrelationships between these factors will be considered. In this way, we will understand what the application of online learning is to children with typical development and children with ASD.

The second part of the study aims to examine what the views of parents of children with ASD are about online learning, how the child goes through it and how the elements of online learning reflect on some factors - such as the overall functioning of the family, the parents' perception of their role, Family Life, child's symptoms, child development, including Behavioral, social and emotional status.

3.Design and procedure

The present research was comprised of two studies that included teachers (Study 1) and families (Study 2) of children with ASD. More than seven-hundred teachers who work as teachers in typical and in schools for children with special needs (N = 705) received a questionnaire about their self-efficacy in online learning technologies, while N = 107 parents received another questionnaire about the family experience and quality of life of their family with a child/children with autism and its relationship with online lessons and interventions.

3.1 Study 1 with Teachers of Autistic Students

3.1.1 Research questions

For this part, the aim was to assess the familiarity with and use of information and communications technologies (ICT) by teachers of general and special education. Specifically, four research questions (RQ) were formulated:

RQ1. How familiar are teachers of general and special education with ICT?

RQ2. How much do teachers of general and special education use ICT?

RQ3. What is the relationship between attitudes towards computers and computer use self-efficacy?

RQ4: Is there an effect of demographic and work characteristics on attitudes towards computers and computer use self-efficacy?

Based on the research questions for Study 1, the following hypotheses (H) are formulated:

H_1: Teachers in our study will show positive views regarding computers

H_2: Teachers in our study will be confident using computers

H_3: Teachers in our study will have high computer use self-efficacy

H_4: There will be high significant correlation between computer self-efficacy and computer attitudes of the teachers in our study

H_5: There will be high significant correlation between confidence with computers and computer attitudes of the teachers in our study

H_6: There will be significant effect of ICT training on computers attitudes of the teachers in our study

H_7: There will be significant effect of ICT training on confidence with computers of the teachers in our study.

3.1.2 Participants

The total number of participants for the study was N = 705 teachers of primary and secondary education. The participants were approached with a non-random convenience sampling method. Participants had to be adult teachers who served in primary and secondary general and special education.

3.1.3 Instruments

The study used a quantitative questionnaire approach. The questionnaire comprised of three sections. The first section collected demographic and other information for the sample, including gender, age, position, school type, years of experience, and training in ICT. This section also asked of the participants to respond to four items pertaining to their use of ICT.

The second section included the Greek Computer Attitudes Scale (GCAS) by Roussos (2007). It is comprised of 30 items that assess teacher's views about the use of computers. The questionnaire provides a total computer attitudes score as well as three subscores for Confidence with computers (15 items); Affection/Feelings for computers (10 items); and Cognitions about computing and computers (5 items). The total score and the subscores are calculated by adding up all relevant item responses. Sixteen items

are reverse-coded. The questionnaire is rated on a five-point Likert scale ("completely disagree" to "completely agree") and has demonstrated high reliability and validity (Roussos, 2007).

The third section is the Greek Computer Self-Efficacy Scale (GCSES) (Kassotaki & Roussos, 2006) of 29 items that provide a total score for teachers' self-efficacy in using a computer, or the extent to which they feel competent in using and solving simple problems that occur when using a computer. The items are rated on a five-point Likert scale ("completely disagree" to "completely agree") and the questionnaire has been found to have acceptable validity and reliability.

3.1.4 Procedure

Participants were approached in the school environment or through electronic mail by virtue of the academic and professional connections of the researcher. The aim of the research was briefly described and all potential participants were informed that their participation is anonymous and voluntary. No deception was used in this research and there was no physical or psychological risk or harm incurred on the participants.

3.1.5. Statistical analysis

The data was entered and coded into the SPSS version 25. Descriptive analysis was provided for the demographic and other information of the sample, though frequencies and percentages, while descriptive statistics were calculated for the items of the Greek Computer Attitudes Scale (GCAS) and the Greek Computer Self-Efficacy Scale (GCSES), through means and standard deviations. Next, Cronbach alpha reliability was computed for the scales and subscales of the questionnaire and the dimensions of the study were calculated. The means and standard deviations for the computer attitudes and self-efficacy of teachers was provided, and the data was tested for normality using the Kolmogorov-Smirnov normality test. Given that the data did not follow the normal distribution, non-parametric Spearman rho correlations were performed between the dimensions of the study. Additionally, Mann-Whitney and Kruskal-Wallis tests were used to examine the potential effect of gender, age, ICT training and position (general or special education), as categorical independent variables, on the attitudes and self-efficacy of teachers regarding computer use, as continuous dependent variables. Mann-Whitney tests were used for the dichotomous independent variables of gender, position

and training in ICT, while a Kruskal-Wallis test was used for the independent variable of age.

3.1.6 Results

Demographic information and use of ICT

Participants were 88% female and 12% male. Their ages varied, with 53% of teachers being between 26 to 40 years old and 39% over 40 years of age. Most participants were general education teachers (76%), with 24% working in special education. Most teachers worked in high school (67%), while the remaining 33% worked in elementary school. Many participants had less than five years of experience (43%), with 16% having 5 to 10 years, 18% having 11 to 15 years, and 23% having more than 15 years of work experience. The majority of the teachers had undergone training in ICT (61%). The large majority was compelled to use ICT due to the pandemic (89%), while the school environment helped 33% in the use of ICT at least a lot. Thirty percent were not helped by their school environment (30%). Overall, the school principal encouraged 41% of teachers to use ICT at least a lot, while 24% of teachers were encouraged a little or were not encouraged at all. Before the onset of distant education, overall 37% used ICT at least often in their teaching, while overall 36% used it a little or did not use it at all.

Results for the Computer Attitudes Scale

On average, and in order of importance, teachers "agreed" that computers do not scare them at all (4.13), that they could learn to use any computer software (3.99), that they feel comfortable when they have to use a computer (3.90), that they have a lot of self-confidence when it comes to using a computer (3.89), that they could get good grades in computer courses (3.85), that they enjoy working with computers (3.80), that if someone gives them a new computer to look at, they could get some programs to run (3.79), that anyone can use a computer (3.79), and that computers are enjoyable (3.74). On the other hand, on average teachers "disagreed" that not many people can use computers (2.13), that computers are boring (1.97), that one has to be young to learn how to use a computer (1.86), that one needs to be "brainy" in order to work with computers (1.83), that computers are difficult to understand (1.81), that they hesitate to use a computer for fear of making mistakes they cannot correct (1.80), and that they are no good with computers (1.79). Participants also disagreed that they hope to never reach

the point of having to use computers (1.71), that they are not the type to do well with computers (1.70), that they need someone experienced nearby when they use a computer (1.68), that they avoid using a computer whenever they can (1.60), that they feel hostile towards computers (1.56), that they hesitate to use a computer in order not to look like a fool (1.50), or that they get a sinking feeling when they think of using a computer (1.50).

In all remaining items, the teachers on average neither agreed nor disagreed.

Results for the Computer Use Self-Efficacy Scale

On average and in order of importance, teachers "completely agreed" that they feel they can copy parts of a text to another section of the same text (4.68), search for information on the internet using search engines (4.67), download files from the internet (4.67), compose texts on the computer (4.63), forward email they have received to other recipients (4.62), format text documents (4.60), download and read email attachments (4.59), move files to a folder on the computer (4.57), and use the spell check provided by word processors (4.52).

The teachers on average "agreed" on all other items. Specifically, they agreed that they can organize computer files into folders (4.47), import objects (4.35) and use objects comfortably (4.30), modify files for printing (4.26), tackle simple computer problems (4.26), customize the interface of applications they use (4.17), save files to any storage media (4.16), understand concepts related to computer hardware (4.07), backup their computer files (4.04), modify file properties (3.94), update computer programs (3.91), and overcome issues like computer freezes or crashes (3.82).

Furthermore, teachers agreed that they can use a program's help files to learn something they didn't know (3.82), understand computer storage (3.79), learn how to use a new version of a program by reading the manual without help (3.73), understand concepts related to computer software (3.67), understand computer speed (3.65), draw graphics (3.57), as well as buy the appropriate software (3.52) and hardware (3.52) based on their needs.

Reliability, mean scores and normality for the scales of the study

A series of Cronbach alpha tests were performed that showed that all scales and subscales had adequate reliability. Specifically, the total scale of computer attitudes had a high reliability of a = 0.93 (30 items), while the "confidence with computers" and

"affection towards computers" subscales respectively had a = 0.92 (15 items) and a = 0.83 (10 items). The subscale of "cognitions about computing and computers" had a lower but acceptable alpha reliability (a = 0.66, 5 items). The computer uses self-efficacy scale had a very high reliability of a = 0.97 (29 items). Prior to calculating reliability, all negatively-worded items were recoded.

As a result, the dimension of computer attitudes and its subdimensions, and the dimension of computer self-efficacy, were calculated. Overall, the teachers on average agreed with all positively-worded dimensions and subdimensions of the study. Specifically, they had positive attitudes towards computers (mean sum score of 115.81, or 3.86 on the Likert scale); they were confident with computers (mean sum score of 59.41, or 3.96 on the Likert scale); they felt positively about computers (mean sum score of 39.28, or 3.93 on the Likert scale); and they had positive thoughts about computing and computers (mean sum score of 19.35, or 3.87 on the Likert scale). Even higher was the teachers' self-efficacy regarding computer use (mean sum score of 120.59, or 4.16 on the Likert scale).

Correlations between the dimensions of the study

Given the finding that the data does not follow the normal distribution, a series of non-parametric Spearman correlations were performed between the dimensions and subdimensions of the study. Results showed that computer self-efficacy had high positive and statistically significant correlations with the dimension of computer attitudes (rho = 0.71, p <0.0005), as well as with the attitudes subdimensions of confidence (rho = 0.76, p <0.0005) and affection (rho = 0.54, p <0.0005), while it had a low positive correlation with cognitions (rho = 0.31, p <0.0005). Furthermore, it is interesting to note that all computer attitudes subdimensions had positive statistically significant correlations, which were low for affection and cognitions (rho = 0.30, p <0.0005), medium for confidence and cognitions (rho = 0.48, p <0.0005), and high for confidence and affection (rho = 0.74, p <0.0005).

Effects of gender, age, position and ICT training on the dimensions of the study

There was a statistically significant effect of gender on affection for computers (U = 21925.0, p = 0.012) and cognitions about computing and computers (U = 20737.5, p = 0.001). Specifically, males (N = 85) had lower affection (37.76) and lower cognitions about computers (18.06) than females (N = 620, 39.48 and 19.52, respectively).

There was also a statistically significant effect of position (general/special education teaching) on confidence with computers ($U = 39525.0$, $p = 0.010$). Being a general education teacher or a special education teacher did not affect the total dimensions of computer attitudes or computer use self-efficacy, or the computer attitudes subdimensions of affection for computers or cognitions about computing and computers (all $p > 0.05$). Specifically, general education teachers ($N = 535$, mean 58.77) had lower confidence with computers compared to special education teachers ($N = 170$, mean 61.44).

Furthermore, there were statistically significant effects of ICT training on the dimension of computer attitudes ($U = 49362.5$, $p < 0.0005$), as well as on the subdimensions of confidence ($U = 49812.5$, $p < 0.0005$) and affection ($U = 49412.5$, $p < 0.0005$). ICT training also had a significant effect on the dimension of computer use self-efficacy ($U = 53912.5$, $p = 0.048$). Specifically, teachers who had received ICT training ($N = 430$) had more positive attitudes towards computers, higher confidence and affection towards computers, as well as higher computer use self-efficacy, compared to teachers who had not received ICT training ($N = 275$).

Age had a statistically significant effect on all dimensions and subdimensions of the study, specifically, on the dimension of attitudes towards computers ($H = 27.50$, $p < 0.0005$); on confidence with computers ($H = 37.58$, $p < 0.0005$); on affection for computers ($H = 22.06$, $p = 0.001$); on cognitions about computers ($H = 20.47$, $p = 0.002$); and on the dimension of computer use self-efficacy ($H = 36.10$, $p < 0.0005$).

Non-parametric post-hoc tests were performed which indicated that for the total score of computer attitudes, teachers 46 to 50 years old and teachers over 50 years old had less positive attitudes about computers, compared to teachers aged 26 to 30 years old ($p = 0.010$ and $p = 0.003$ respectively) and teachers aged 41 to 50 years old ($p = 0.015$ and $p = 0.006$ respectively).

For the subscale of confidence with computers, post hoc tests showed that teachers over 50 years old had lower confidence with computers than teachers 26 to 30 years old ($p < 0.0005$), 31 to 35 years old ($p = 0.003$), and 41 to 45 years old ($p = 0.028$). Furthermore, teachers aged 46 to 50 years old also had lower confidence in their use of computers than teachers aged 26 to 30 years old ($p < 0.0005$) and 31 to 35 years old ($p = 0.021$).

Regarding the subscale of affection for computers, post-hoc tests indicated that teachers aged 46 to 50 years old had less affection for computers than teachers aged 31 to 35 (p

= 0.047) and 41 to 45 years (p = 0.008), while participants over 50 years old also had less affection for computers than participants 41 to 45 years old (p = 0.049).

Concerning teachers' cognitions about computing and computers, participants aged 31 to 35 years old had less positive cognitions than participants aged 26 to 30 years old (p = 0.024) and 41 to 45 years old (p = 0.007).

Finally, with respect to the total score of computer self-efficacy, participants aged up to 25 years old actually had lower computer self-efficacy than participants aged 26 to 30 years old ($p < 0.0005$), 31 to 35 years old (p = 0.003) and 41 to 45 years old (p = 0.015). Participants over 50 years of age also had lower computer self-efficacy than participants aged 26 to 30 (p = 0.002) and 31 to 35 years old (p = 0.036). Additionally, teachers 46 to 50 years old had lower computer self-efficacy than teachers 26 to 30 years old (p = 0.019).

3.2 Study 2 with Parents of Autistic Students

3.2.1 Research questions

With regard to the parent evaluations, the purpose was to assess the views of parents regarding the experience and quality of life of their family with a child or children with autism; as well as to assess the impact of online learning on various aspects of child and family functioning. Toward that aim, the following research questions (RQ) were posed:

RQ5. What level of autism family experience and quality of life do parents report?

RQ6. Do parents feel that their autistic children benefit from online lessons and interventions in their developmental, behavioral, social and emotional skills?

RQ7. Do autistic students' online lessons/interventions affect the experience and quality of life of the family?

Based on the research questions for Study 2, four hypotheses (H) were formulated:

H_1: The interaction with teachers during online teaching will have a significantly positive effect on child symptoms

H_2: The interaction with other students during online teaching will have a significantly positive effect on child symptoms

H_3: The student's concentration during online lessons/interventions will have a significantly positive effect on child symptoms

H_4: The improvement through online lessons/interventions will have a significantly positive effect on child symptoms.

3.2.2 Participants

The sample was comprised of 107 parents, primarily mothers (80%), who have at least one child with autism. The sampling method utilized was one of random probability sampling, according to which potential candidates were approached based on their suitability for inclusion in the study. The inclusion criteria were that appropriate parent participants should have one or more children with autism, aged 3-12 years old, where autism is defined as having received a diagnosis of the autistic spectrum. Exclusion criteria included those parents with older autistic offspring, for example, adolescents or adults, were not incorporated in the study.

3.2.3 Instruments

The Autism Family Experience Questionnaire v.4 (AFEQ) (Leadbitter et al., 2018), is a measure of the experience and the quality of life of the family that include a child or children with autism. It is designed to offer informed information concerning early intervention applications for children with autism. The AFEQ was translated into the Greek language after the consent and according to the instructions of the designers of the questionnaire. The instrument is comprised of 48 items, measured on a 5-point Likert-type scale, with the scoring of the questionnaire involves the summing up of item responses into a total AFEQ score, as well as into the four dimensions of "experience of being a parent of a child with autism" (items 1-13), "family life" (items 14-22), "child development, understanding and social relationships" (items 23-36), and "child symptoms, feelings and behavior" (items 37-48). In order to score the AFEQ, nineteen (19) items are negatively worded and need to be reverse-coded, with the range of possible scores for the total scale is 48-240, with lower scores representing a better family experience and higher scores signifying the existence of poor outcomes.

Furthermore, two other sections were included in the survey. The first of these collected data on participants' demographic information. The second section involved 6 items relating to online learning.

3.2.4 Procedure

Parent participants were approached within the school environment or through the use of electronic mail through the researcher's academic and professional contacts. All potential respondents were briefed about the aim of the research and they were informed that their participation is anonymous and voluntary. The study did not use deception of

any kind, and there was no psychological or other risk or harm incurred on the participants.

3.2.5 Statistical analysis

In order to analyze the data for the AFEQ study, descriptive and inferential statistics were used via the SPSS 26.0 statistical software package. Descriptive analyses were performed for the main items of the questionnaire (means, standard deviations), as well as for the characteristics of the parents and their children with autism, including the family characteristics and the academic and online lesson/intervention characteristics of the children (frequencies, percentages). The internal consistency of the total AFEQ scale and its subscales was examined with the use of Cronbach reliability tests. Further, normality was assessed using Kolmogorov-Smirnov tests, which indicated that the dimensions of the study did not follow the normal distribution. Therefore, non-parametric statistical tests were utilized in the inferential analysis, specifically a series of Kruskal-Wallis tests, with the child's current educational level and the six items of online lessons/interventions as independent variables, and the total AFEQ score as well as its four dimensions, as dependent variables. For statistically significant results (where $p > 0.05$), pairwise comparisons with Bonferroni correction for multiple tests were performed.

It is noted that gender of parent and autistic children's participation in extracurricular activities were not included in these tests, because one of their response categories had too few cases – for gender, fathers were only N = 11 (Mothers N = 96), while only N = 11 autistic children did not participate in extracurricular activities (N = 96 took part in extracurricular activities).

3.2.6 Results

Characteristics of the parents and their children with autism

The sample of N = 107 parents of children with autism, was primarily comprised of mothers (90%). Approximately half of the families resided in urban areas (49.5%) and rural, provincial areas (50.5%). Most parents had more than one children (79%), while 21% of the parents had one child. The majority of the parents had one child with autism in the family (70%), while 30% of the parents reported more than one offspring with autism. Specifically, 60% had one child with autism and one or more children without autism, and 20% had at least two children with autism in the family. The yearly family

income varied between up to €10.000 (31%), up to €30.000 (40%), and more than €30.000 (29%). The mothers of the study had received Bachelor's degrees (50.5%) or Master's degrees (295), while 21% had completed secondary school. Most fathers had either attended secondary school (50.5%) or had received a Bachelor's university degree (40%), with 9% having a PhD degree.

Furthermore, most children with autism involved in the study were attending secondary school (60%), with 21% in primary school and 20% at the preschool level. Most children with autism were attending mainstream schools (80%). Specifically, 49.5% were attending mainstream schools and 31% were attending mainstream schools with parallel support. Additionally, 10% were attending special education schools, and 9% attended special education schools with parallel support. Most children with autism participated in extracurricular activities (90%). Additionally, most of the children with autism slept between 7-8 hours (49.5%) and 9-10 hours (40%), with 10% of children sleeping for less than 7 hours per night.

On the items relating to online lessons/interventions, 40% of the parents reported that their children with autism interact with the teachers during online teaching; another 40% of the parents reported that their offspring did not interact with teachers online. The remaining 20% of the parents didn't know or didn't want to respond. Additionally, 41% of parents reported that their children interacted with other students during online teaching, while 30% replied that their children did not interact with their peers online. One in two parents thought that their child feels sleepy or bored during the online lessons/interventions (49.5%), while 21% of the parents did not think that their offspring are bored/sleepy during online class. To the question whether their child is showing improvement because of the online lessons/interventions, 40% of parents answered "yes" while 30% answered "no". A relatively small proportion of the parents replied that their child needs supervision during the online lessons/interventions (29%), while 41% replied that their offspring did not need supervision. Additionally, most parents felt that their offspring can concentrate during the online lessons/interventions (61%). Only 9% reported that their offspring cannot concentrate.

Parents' responses to the items of the Autism Family Experience Questionnaire

Regarding the parents' scores on the individual items of the Autism Family Experience Questionnaire (AFEQ), the following were found. In the 13 items on the experience of being a parent of a child with autism, the parents reported a moderate level of

agreement, indicating on average that the feelings, thoughts and behaviors were "sometimes" true. Regarding the items of family life with a child with autism, the parents reported moderate agreement with most items ("sometimes"), while they reported that family life is "rarely" calm and their child is "rarely" flexible in adapting to the demands of family life. In the 14 items on child development, understanding and social relationships, on average the parents reported a moderate level of agreement concerning the mentioned child's skills, feelings and behaviors ("sometimes"). With regard to the 12 items of child symptoms, feelings and behavior, the parents on average agreed moderately with most items ("sometimes"), while they reported that their child is "rarely" embarrassing when going out and that the repetitive behaviors of their child "rarely" make day to day life impossible.

Reliability, mean scores and normality for the scales of the study

For the above groups of items, as well as the total number of items of the AFEQ scale, internal consistency was evaluated through the use of Cronbach reliability tests. The total Autism Family Experience scale had high reliability with a = 0.91 (48 items). Three out of the four subscales also had high reliability > 0.7 (experience of being a parent, family life, child development). Only the subscale of child symptoms had lower reliability (a = 0.61, 12 items), however it was retained in the analysis in order to prevent loss of data. However, it was noted that if item 48 was removed, the reliability for the subscale of child symptoms would increase to a = 0.66 (11 items). Based on the above reliability findings, the total AFEQ dimensions as well as its four subdimensions were calculated. All responses were valid (N = 107).

The mean Total AFEQ score was 140.52, which in the range of 48 to 240 is placed in the lower moderate (towards low) level of family dysfunctionality and decreased quality of life. The subdimensions also received moderate mean scores. Specifically, the experience of being a parent score had a score of 37.97 (in a scoring range of 13-65); the mean score for child development was 41.26 (range 14-70); and the mean score for child symptoms was 34.84 (range of 12 to 60). The mean score for the subdimension of family life was the lowest (signifying a better outcome), with a moderate to low score of 26.28 (range 9-45).

For the above study dimensions, Kolmogorov-Smirnov tests that were performed showed that the data did not follow the normal distribution.

Relationships between the dimensions of the study

Concerning the relationships between the dimensions of the study, the following were found. Kruskal-Wallis tests were performed, with the Total AFEQ dimension and its four subdimensions as dependent variables (experience of being a parent, family life, child development, child symptoms). The independent variables were seven (7) and they were the following: child current educational level; interaction of child with autism with teachers during online teaching; interaction of child with autism with other students during online teaching; sleepiness/boredom during online lessons/interventions; student's improvement through online lessons/interventions; student's need for supervision during online lessons/interventions; and finally student's ability to concentrate during online lessons/interventions.

The current educational level of the autistic child had a significant effect on the total AFEQ and 3 out of 4 dimensions (all $p < 0.001$), with the exception of child symptoms. Pairwise post-hoc comparisons with Bonferroni correction showed that in the dimension of Total Autism Family Experience, as well as in the subdimensions of Experience of being a parent and Child development, preschool children had significantly lower –better– scores compared to secondary and primary school students (all $p < 0.001$). In the subdimension of Family life, preschool students had a significantly better score than primary school students, who in turn had a better score than secondary school students ($p < 0.001$).

Interaction with teachers during online teaching, had a significant effect on the Total AFEQ as well as on the four study subdimensions (all $p < 0.001$). Pairwise comparisons revealed that in all cases, autistic children who –their parents reported that they– interacted with teachers during online teaching, had significantly lower –better– scores compared to children that did not interact with their teachers (all $p < 0.001$).

Interaction with other students during online teaching had a significant effect on the Total AFEQ as well as on the four study subdimensions (all $p < 0.001$). Pairwise comparisons showed that in the Family life and Child development subdimensions, students who interacted with other students had a significantly better score than students who did not interact with other students ($p < 0.001$). In the Total AFEQ, as well as the subdimensions of Experience of being a parent and Child symptoms, autistic children whose parents didn't know/didn't want to report if their offspring interacted with their peers during online teaching, had significantly higher–worse– scores than all other cases ($p < 0.001$).

Furthermore, there was a statistically significant effect of student sleepiness/boredom during online lessons/interventions, on the Family life and Child symptoms subdimensions ($p < 0.001$). Pairwise comparisons showed that in Family life, students who felt bored or sleepy during online lessons/interventions, had a significantly better –lower– score than all other students – who either did not feel sleepy/bored or whose parents didn't know if they felt bored in online class ($p < 0.001$). In Child symptoms, students deemed to feel bored/sleepy during online class, had a better score than students whose parents didn't know if they felt bored/sleepy ($p < 0.001$).

Additionally, the extent to which parents felt that their children improved as a result of the online lessons/interventions, had a statistically significant effect on the subdimensions of Family life ($p < 0.05$) and Child symptoms ($p < 0.001$). Specifically, for Family life, students who improved had a significantly better –lower– score than students whose parents did not know if their children were improving ($p < 0.05$). Concerning Child symptoms, students who showed improvement, as well as those who didn't, had significantly better scores compared to students whose parents didn't know if they were improving through online teaching ($p < 0.001$).

The two subdimensions of family life and Child symptoms were again significantly affected by autistic students' need for supervision during online lessons/interventions ($p < 0.001$). Pairwise comparisons revealed that students who were deemed to need supervision had significantly better –lower– Family life scores compared to all other students ($p < 0.001$). Students who needed supervision during online learning, and those who didn't, both had significantly better scores than students whose parents didn't know if they needed supervision ($p < 0.001$). Finally, there was a statistically significant effect of student's concentration during online lessons/interventions on the Total AFEQ dimension as well as on 3 out of 4 subdimensions ($p < 0.001$), with the exception of Experience of being a parent. Pairwise comparisons indicated that in the Total Autism Family Experience dimension, students who could concentrate has a significantly better score than students who could not concentrate, who in turn had a better score than students whose parents didn't know if their children could concentrate ($p < 0.05$).

In Family life, students who could concentrate had a significantly better score than students who could not concentrate and students whose parents didn't know if their children could concentrate ($p < 0.001$). In Child development, as well as in Child symptoms, autistic students who could not concentrate had a significantly worse score than all other autistic students ($p < 0.001$).

4. Discussion

4.1 Discussion of Study 1 with Teachers of Autistic Students

In Study 1 of the present research, attitudes towards ICT and computer self-efficacy were examined in 705 teachers in primary and secondary education. In general, the teachers held positive views regarding computers, felt confident with and had positive cognitions and feelings about computing and computers. The teachers had an even higher computer use self-efficacy. Computer use self-efficacy was significantly and highly positively related with computer attitudes and its subscales of confidence and affection, and self-efficacy had a low positive correlation with cognitions about computing and computers. Therefore, the three hypotheses for Study 1 were confirmed, and the teachers showed positive views regarding computers (hypothesis H_1); the teachers were also confident using computers (hypothesis H_2); and the teachers had high computer use self-efficacy (hypothesis H_3). Additionally, teachers' attitudes towards computers were highly and significantly positively correlated with teachers' computer self-efficacy (hypothesis H_4) and with teachers' confidence with computers (hypothesis H_5).

In the context of hypotheses H_6 and H_7, ICT training, but also gender, position and age significantly affected the attitudes and self-efficacy of teachers regarding computer use. Thus, teachers who had had ICT training held more positive views towards computers, had more confidence and higher affection for computers, and also showed more computer use self-efficacy than teachers without ICT training. Additionally, male teachers exhibited less affection and less positive cognitions about computers than did females; general education teachers showed less confidence with computer use than special education teachers (computer attitudes subdimension); and there was no effect of position (general or special education teaching) on total computer attitudes or computer use self-efficacy, nor on affection for computers and cognitions about computing and computers (computer attitudes subdimensions).

Finally, age affected attitudes towards computers as well as computer use self-efficacy. In general, older teachers had less favorable attitudes towards computers, less confidence, less affection and less positive cognitions regarding computers, compared to younger teachers. Older teachers also had lower computer use self-efficacy than

younger teachers, with the exception of teachers aged up to 25 years old, who had lower computer self-efficacy than teachers 26 to 35 years old and 41 to 45 years old.

Overall, teachers with ICT training, female teachers, and younger teachers had more favorable attitudes towards computers, and higher affection towards computers than teachers without ICT training, male teachers, and older teachers. At the same time, teachers with ICT training and younger teachers had higher computed use self-efficacy, compared to older teachers and teachers who had not had ICT training. Younger teachers and special education teachers were also more confident with computer use compared to older teachers and general education teachers. These findings appear to suggest that computer use self-efficacy and other variables relating to attitudes towards computers, are determined by a number of other participant characteristics, and these should be taken into consideration when examining teachers' attitudes towards ICT.

The finding that the youngest teachers (up to 25 years old) had lower computer self-efficacy compared to young adult and middle-aged, but not older, teachers, may be due to the fact that teachers between 26 and 41 years old are more experienced in their profession and this instils confidence in their capabilities as educators. At the same time, teachers between 25 and 41 years old have grown up during a period when electronic communications, computers and other ICT technologies were already being developed; these teachers were as accustomed and as familiar with these technologies than younger teachers, but they were not too old to have been brought up in an exclusively, or partly, analog society. Finally, teachers aged 25-41 years old may have had the opportunity to attend more ICT seminars and other educational programs than younger teachers.

The present study found a strong relationship between attitudes towards computers and computer use self-efficacy, as well as a strong influence of demographic and job characteristics on computer use attitudes and self-efficacy. Further research is proposed in order to gain more knowledge and insight into these factors and their relationships, so that the effective use of ICT in the classroom can be fostered for the benefit of the students, the teachers and society at large.

4.2 Discussion of Study 2 with Parents of Autistic Students

The purpose of Study 2, was to examine the views of parents of children with autism, concerning their family experience and quality of life. The relevant research questions related to the assessment of the levels of autism family experience and quality of life

that parents report; of the benefits in behavioral, social and emotional skills for autistic students through participation in online lessons and interventions; and of the extent to which participation in online lessons/interventions affects the experience and quality of life of the family of children with autism.

The sample was comprised of 107 parents, primarily mothers (90%), of autistic children who mostly attended mainstream education (80%) in secondary school (60%), primary school (21%) or at the preschool level (20%). Parents provided their own views and perspectives regarding their autism family experience and life quality, as well as the performance of their autistic children in online lessons/interventions.

With regard to parental views on their autistic children's participation in online lessons/interventions, 40% of students interacted and 40% did not interact with the teachers during online teaching; 41% of students interacted and 30% did not interact with other students during online teaching; 50% of students felt sleepy/bored and 21% did not; 41% did not need supervision and 29% did need supervision during the lessons/interventions; and 61% of the students could concentrate during the online lessons/interventions – only 9% of the students were reported to not be able to concentrate. Importantly, 40% of the parents reported that their autistic children showed improvement because of their participation in online lessons/interventions; 30% of the parents felt that their children did not improve as a result of the online teaching. It is interesting to note that in all six items relating to online lessons/interventions, there was a large proportion of parents who did not know how to respond, or did not want to respond (20%-30%). In particular, in four out of six items, almost one in three parents didn't know or didn't wish to respond (30%).

Possible explanations for the fact that approximately 20%-30% of the parents did not respond to these questions, may be that these parents did not follow up on their children's progress; the parents may not believe that computers and online learning are helpful for their children with autism, perhaps because they associate computer use with games and entertainment, not with academic learning; or these parents may feel that their children with autism cannot really achieve improvements through the use of online lessons and interventions.

Another reason for the low proportion of responses from these parents may be that their experience with their child with autism is demanding and they may feel frustrated, especially in light of the fact that they reported an average quality of life, which was not high. Specifically, concerning their responses to the items of the Autism Family

Experience Questionnaire (AFEQ), overall the parents reported a moderate level of family experience/quality of life, neither a positive nor a negative experience. Specifically, participants reported moderate levels on the items of the experience of being a parent of a child with autism, as well as on the items of child development, understanding and social relationships. The parents also reported a moderate level in the items of family life, except for two items signifying that family life is “rarely” calm and that their autistic child is “rarely” flexible to adapt to the requirements of family life. The parents also reported a moderate level of agreement in the items of child symptoms, feelings and behavior, with the exception of two items, where they indicated that their child is “rarely” embarrassing when they go out, and that their child’s repetitive behaviors “rarely” make everyday life impossible.

In the total dimension and subdimensions of the study that were calculated, given good reliability results, the total Autism Family Experience (AFEQ) score was 140.52 (response range 48-240), indicating a moderate to low level of family dysfunctionality or decreased quality of life. The same levels were recorded for three of its subdimensions, experience of being a parent of a child with autism (37.97, range 13-65), child development, understanding and social relationships (41.26, range 14-70), and child symptoms, feelings and behavior (34.84, range 12-60). The best score was recorded for family life, which was a moderate to low score (26.28, range 9-45).

In the inferential statistical tests that were conducted, the current educational level and the online lesson/intervention participation characteristics of the autistic students, had a large and statistically significant effect on parental views regarding their autism family experience and quality of life, in the total dimension as well as on the subdimensions. Results indicated that family quality of life may be a multidimensional construct that is affected by many different factors. The finding that parents who report more positive online learning characteristics for their children with autism, also feel better within their family and report an overall higher family quality of life, may be due to the fact that these parents feel that they are acting on their child’s best interest – they are “doing something” when they include their children in education and provide them with educational opportunities. Furthermore, parents with a higher educational level may be more aware of the benefits that educational interventions and lessons may have on their child’s development, compared to parents who have not participated in higher education.

Specifically, the child's current educational level significantly affected the total Autism Family Experience score as well as 3 out of 4 subdimensions, except for child symptoms. In all of the above, preschoolers had significantly better scores than primary school students. In the total scale and in the subdimensions of experience of being a parent and child development, preschool students also had better scores than secondary school students, while in family life, primary school students had a better score compared to secondary school students. This finding may be explained by the fact that there are developmental differences in the ways in which children learn at different ages. Another explanation may be that parents of younger children with autism have experienced the challenges of raising an autistic child for a longer period than other parents, and this fact may be reflected on parents' views on their family quality of life. Furthermore, all six items on online lessons/interventions significantly affected the levels of family life quality and child symptoms reported by the parents. Additionally, the total autism family experience score, as well as child development, were significantly affected by three items (interaction with teachers, interaction with other students, concentration). Finally, the experience of being a parent of a child with autism was significantly affected by two online lessons/interventions items (interaction with teachers, interaction with other students).

An overview of statistically significant effects for the items of autistic children's participation in online lessons/interventions saws that interaction with teachers and interaction with other students during online teaching were the two factors that significantly affected all facets of the autism family experience/quality of life. Autistics students' concentration during online lessons/interventions also affected most family experience features, except for experience of being a parent. Sleepiness/boredom, need for supervision, and improvement, significantly affected only the family life and child symptoms subdimensions.

Therefore, the first three research hypotheses for Study 2 were confirmed, and during online teaching, the interaction with teachers (hypothesis H_1), the interaction with other students (hypothesis H_2), and the student's concentration (hypothesis H_3), all had a positive effect on child symptoms, as well as on child development. Furthermore, hypothesis H_4 was also confirmed, since the child's improvement through online lessons/interventions –as well as all other online lesson factors– had a significant and positive effect in reducing child symptoms.

Based on the above, children with autism who concentrate and who interact with teachers and other children during online learning, may represent for parents an image of typical child development, that they can observe and judge for themselves. Parents need to see that the child can communicate, and online education does not only contain the component of learning, but it also includes behavioral and emotional socialization components for the child with autism. All of these characteristics then may have an influence on the child's symptoms. Therefore, it can be argued that according to the parents, online lessons and interventions have some positive effects on the emotional and behavioral status of the child.

Specifically, a main conclusion from the analysis is that autistic students' interaction with teachers during online lessons/interventions affected every aspect of the family quality of life experience (measured through the AFEQ scale), where autistic children that did interact had better AFEQ scores compared to students who did not interact with their teachers. Interaction with other students during online lessons/interventions also affected all facets of the AFEQ measures, where the families of autistic students that interacted with their peers reported better outcomes, compared to students who did not interact with other students (in family life and child development), as well as compared to students whose parents didn't know/didn't want to report whether their autistic child interacted with peers or not (in all aspects of the AFEQ scale).

Furthermore, autistic students' concentration during the online lessons/interventions significantly affected all facets of the AFEQ measures, except for the experience of being a parent of a child with autism. Specifically, in all of the above cases, students who could concentrate during online teaching outperformed students who could not concentrate, and they also had better scores than students whose parents didn't know/didn't respond if their children could concentrate or not, in the subdimensions of family life, child development and child symptoms. Additionally, autistic students who could not concentrate during online teaching also had significantly better scores that students whose parents didn't know/didn't respond, in the total AFEQ scale as well as in child development and child symptoms.

On the other hand, a further conclusion from the analysis is that autistic students' sleepiness or boredom, need for supervision, and improvement during the online lessons/interventions, did not affect the overall family quality of life, but did significantly affect the family life and child symptoms aspects of the autism family life experience. Specifically, students who felt bored/sleepy during online teaching received

better scores in family life and child symptoms compared to students whose parents didn't know/didn't respond. Interestingly, they also scored better in family life compared to students who were actually not bored/sleepy during online class. Possible explanations for these findings may be, first, that children whose parents did not provide a response may be less knowledgeable about their child's school and online participation, and may potentially lack in guidance of their autistic children, leading to less desirable outcomes concerning the autism family experience and quality of life. Secondly, the fact that some students were bored or sleepy during the online lessons/interventions may not necessarily indicate a lack of knowledge or life skills, but rather may show that these students are already more knowledgeable, or skillful, and the lessons/interventions may feel superfluous to them.

Another interesting conclusion from the analysis is that autistic students who needed parental supervision during online lessons/interventions, received significantly better scores in family life compared to all other students; conversely, students whose parents didn't know/didn't answer had significantly worse child symptoms than all other autistic students, including those who needed parental supervision. Possible explanations for these findings may be, firstly, that autistic students who are under parental supervision during online teaching also demonstrate a high level of cooperation and collaboration with their parents, thus increasing the experienced quality of family life. Additionally, it may be that parents who do not know, or who do not want to discuss whether they supervise their autistic child during online class, are also not knowledgeable or mindful whether their child needs supervision or not, and this fact may be exacerbating the negative symptoms of the autistic children.

A final conclusion from the second study is that autistic students who showed improvement as a result of their participation in the online lessons/interventions, had significantly better outcomes in family life and child symptomatology compared to students whose parents didn't know/didn't respond. At the same time, even students who showed no improvement through their online classes, had a significantly better score in child symptoms, compared to the students whose parents did not know if their children were improving. These findings may again be potentially interpreted to suggest that parents who do not know or who do not want to respond to these types of items, may be lacking the knowledge or the focus on their autistic child's online learning participation, and this distance they may have could be compounding the difficulties

they and their children face in the context of their autistic family experience and quality of life.

5. Limitations and Suggestions for Future Research

The present research has some limitations. Firstly, in order to enlist teachers and parents with autistic children into the research, non-probability, convenience sampling procedures were used. Secondly, even though the findings may not be generalizable to the total population, the present research did combine data from two sources, from parents and teachers who are all important, to varying degrees, for the personal, social and academic life and development of the children. However, the fact cannot be overlooked that the views of the children themselves were not included in the analysis. Future studies should focus on carrying out more comprehensive research designs that include the voices of these "big-three" stakeholders in the successful education and skills improvement of children with ASD, along with the school administrators and policy developers. Additionally, more research is warranted particularly into parents' perceptions of their autism family experience and quality of life, as well as their views on the benefits of online teaching and interventions on children with ASD. Finally, it is suggested that future research should combine quantitative (questionnaire) and qualitative (interview) evidence from parents, teachers and/or autistic students, so that the personal views of these stakeholders are examined and synthesized with the quantitative data, providing for a more rounded approach that may offer insights that may ultimately translate into recommendations and practical applications for online interventions for ASD children.

6. Contributions

An exploratory study on teachers' attitudes towards computers and their efficacy to use computers in Greece was performed (Study 1), while parental views of children with autism in Greece, regarding their family experience and quality of life, and its connection with their child's participation in online learning, were also examined (Study 2). The present research offers the following main contributions.

1. The conclusions of the studies contribute to the literature regarding the effects of online learning lessons and interventions, as well as teacher computer use self-efficacy, for the learning and development of children with autism. Specifically, the teachers of the study were confident in their abilities to utilize online teaching, while parents reported that the online learning opportunities provided for their children with ASD were beneficial for their children's social, behavioral and emotional impact on young children with autism.
2. The findings can be used to inform the planning, design, and application of future online learning lessons and interventions aimed at improving the learning and developmental outcomes for children with ASD. In particular, the importance of teacher computer use self-efficacy, and parents' involvement and positive attitudes towards their child's online learning participation, may be considered in this context.
3. At the same time, the demographic and occupational influences on teachers' levels of computer use self-esteem, as well as on parents' views towards the usefulness of ICT in their child's development, signify that different interventions need to be designed and implemented according to each child's needs and family characteristics, as well as that different teachers need different levels of training according to their personal and work characteristics.
4. A Greek version of the AFEQ questionnaire was administered, which showed good psychometric properties and can be considered in future research for standardization for and use with the Greek population.
5. The present research, through its Studies 1 and 2, has covered the topic of online learning, teachers' attitudes and capabilities and parents' attitudes towards technological educational applications. This is a relatively new method of teaching and learning at schools and it deserves continued research and research-based theory development.
6. Finally, the present thesis has collected and analyzed self-report data from both teachers and parents about online teaching for children with autism, and the information that has been reported, along with other independent research, may provide insight into the way that ASD children perceive everything that happens in online teaching.