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An investigation of students and teachers' new media literacy: the contributing characteristics with the moderator role of gender

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Abstract

This study aims to investigate students and teachers' new media literacy in addition to the contributing factors with a relatively large sample size. In this sense, the current study is considered unique as it provides findings from both student and teacher participants, and investigates the contributing factors to their new media literacy with the moderation of gender. The new media literacy framework was adopted as the theoretical base, and students and teachers' new media literacy was investigated in terms of consuming and prosuming dimensions. The data were collected from 1195 students studying in primary, middle, and high schools (including rural and urban areas) and 581 teachers. The findings revealed that teachers' literacy is higher than students' at all educational levels for all dimensions of the new media literacy framework. It was also found that students' educational level and ICT teachers' subject field positively contribute to their literacies in all dimensions. While teachers' age negatively contributes only to their prosuming skills, it has no influence on their consuming skills. Finally, no significant moderating effect of gender was observed on these relationships while it is found as a predictor of both students and teachers' prosuming skills, and also teachers' functional consuming skills. For these skills in both groups, male participants demonstrated higher literacy than females. Rather than generational differences, the findings underline the role of formal and informal experience in the development of digital literacies, particularly in critical dimensions, and were further discussed based on the current literature.

Keywords: New media literacy, New media environments, Teachers, K-12 students, Digital literacies

Introduction

New media now has a key role in all aspects of life, including education. It is necessary to be included in the instructional curricula to improve this role (Barut Tugtekin & Koc, 2020; Irmak et al., 2023). This is because new media has created rich information services for students with individualized, real-time, and interactive environments enabling them to become lifelong learners and engage in global competition (Lv, 2022). In this context, individuals' possession of technological devices is insufficient to access information, so they are required to be equipped with media and digital literacy skills (Koc & Barut, 2016). In this regard, New Media Literacy (NML) enables people to actively and properly participate in production and consumption via new media tools. As an example, a study by Luo et al. (2022) demonstrated that NML is a significant factor in the evaluation of news trustworthiness in new media environments. With this in mind, NML has become a required competency for students and teachers to integrate new media tools into education effectively (Kara et al., 2018). Likewise, Barut Tugtekin and Koc (2020) advocate the development of curricula for students to acquire the required skills of today's digital society.

There are several challenges faced in the integration of new media tools into education (Vongkulluksn et al., 2018). One of these challenges is pointed out as the so-called "digital native-immigrant" stereotypes (Evans & Robertson, 2020; Prensky, 2001). Considering the frequent and immersive usage of technology by today's students, the concerns regarding the gap between students and teachers' digital literacies have been raised as a 21st-century debate. At the beginning of this century, in his influential paper, Prensky (2001) defined the young generation growing in the world of digital and new network environments as digital natives. He stated that the thinking and information processing styles of the young generation, described as digital natives, are much different than their teachers. On the other hand, he defined digital immigrants as individuals who were born before the digital age and met with the digital world later in their lives. In brief, today's students have been assumed as digitally literate in nature (Smith et al., 2020) while many of the teachers are assumed as digital immigrants with inadequate digital literacy to teach their digitally competent students (Evans & Robertson, 2020). Although this native-immigrant distinction has long been criticized, it has also been substantially influential on the academic literature (Smith et al., 2020). Is this claim made by Prensky (2001) about digital competencies still valid for today's students and teachers' NML? This question remains unanswered and thereby, the current study mainly seeks to answer this question. As independent of the validity of the assumption that students and teachers are different in terms of NML, the current study also aims to reveal influential demographic factors on both students and teachers' NML.

Theoretical framework

The present study is based on the NML framework proposed by Lin et al. (2013). They presented four types of NML dimensions: (1) Functional Consuming (FC), (2) Critical Consuming (CC), (3) Functional Prosuming (FP), and (4) Critical Prosuming (CP). Based on Lin et al.'s (2013) framework, FC requires competencies to reach and access media content and grasp the meaning of the accessed text. CC requires the ability to interpret media content within specific social, economic, political, and cultural frameworks. While FP focuses on participation skills in the creation of media content, CP emphasizes the interpretation of media content during participation activities (Lin et al., 2013). Similar to the framework of Chen et al. (2011), the framework proposed by Lin et al. (2013) also shows that they accept NML as four types of literacy and also explain them with ten indicators. In this study, NML was investigated based on these four types of literacy. In the following sections, these four dimensions proposed by Lin et al. (2013) were explained in detail.

Functional Consuming: It covers two indicators: (1) Skill and (2) Understanding. The skill refers to the ability to have the necessary skills to consume media content and the ability to perceive the meaning of the accessed media content in its true sense. The skills of using a search engine can be given as an example. The understanding indicator refers to the ability to perceive the meaning of the accessed media content in its true sense. Individuals must be able to experience this with their environment to interpret models, solve problems, observe their environment, and manage the flow of information among various examples.

Critical Consuming: This dimension includes three indicators: (1) Analysis, (2) Synthesis, and (3) Evaluation. The analysis indicates the ability to change media messages, to understand that media message creation is a subjective process, and to distinguish whether the new media message is a fact or a subjective opinion. The synthesis indicator refers to the ability to interpret and collate media content with their own perceptions and perspectives, and to create media messages in their own way. The evaluation includes the skills of individuals to question and criticize the reliability of media content. As an example, teachers' ability to present different ideas on a topic interactively and students' ability to find reality among these ideas via one of the web tools can be shown.

Functional Prosuming: This dimension encompasses three indicators: (1) Skills, (2) Distribution, and (3) Production. Firstly, the skills indicator expresses a number of technical skills needed to produce media content. The ability to open an account and create products in a web environment can be given as an example. Secondly, the distribution refers to the ability to disseminate information they already have. The presentation of materials developed within the scope of a course on a YouTube channel can be given as an example. Finally, the production includes the capabilities of partially or completely

reproducing, mixing/collating media content. Production activities include mixing audio and video files to create a new video file, digitizing a printed file, and writing something on media such as a blog or social network.

Critical Prosuming: This dimension covers two indicators: (1) Participation and (2) Creation. Firstly, the participation includes the skills to participate in new media environments with interactive and critical perspectives. The underlined point is that individuals or participants are in mutual/bilateral interactions. People are expected to develop ideas by contributing to each other's thoughts in new media environments. The participation focuses on the social connection that values each individual's contribution. An example of this dimension is the interaction of students by using such applications as Google Classroom, Classdojo, or other educational social networks in a course. On the other hand, the creation indicator refers to the ability to create media content with a critical understanding.

Relevant literature on new media literacy

There is increasing attention to the role of new media and NML in education (e.g., Celik et al., 2021; Irmak et al., 2023; Luan et al., 2023; Ugurhan et al., 2020). The reason behind this increasing attention is likely the educational advantages provided by new media tools. Hopp and Gangadharbatla (2016) underlined that new media is an important tool in understanding and explaining students' decisions within the framework of technology acceptance models. Schwart (2015) stated that new media supports students to develop applications and express themselves. Xu (2018) also concluded that new media has a positive effect on learning English for hearing-impaired students. Thus, it is obvious that the existing literature clearly reveals the advantages of new media in education.

The advantages of using new media in education have enhanced the focus on NML research as it can be assumed as a prerequisite for the integration of new media into education. Taking advantage of ICT requires a set of literacies from basic literacies (reading and writing) to functional literacies (Selwyn & Facer, 2013). According to Lee et al. (2015), NML not only covers functional literacies usually referring to knowledge and skills or digital competencies, but also includes critical literacies encompassing meaning and decision-making on the usefulness and trustworthiness of media messages. Both students and teachers are required to have critical literacies in addition to functional ones, as covered by the NML framework used in this study, to benefit from the advantages of new media.

The relevant studies in education investigated NML from diverse aspects. Several studies first discovered students' NML levels. Chandler (2013) determined that upper primary school students have low awareness of new media. In the same vein, Balaban-Sali (2012) indicated that the new media literacy level of the participant university students was

medium. In a relatively recent study, Tomczyk and Wasinski (2017) explored that high school students found the use of new media enjoyable and took a positive attitude. The results of their study show that students are highly new media literate. Chen et al. (2018) conducted a large-scale study to create new media modeling for Singaporean primary, secondary, and junior college students and showed that they are highly new media literate. In more recent studies, the NML levels of adults (Gogus et al., 2023), pre-service teachers (Irmak et al., 2023; Tuğtekin & Mercimek, 2022), and university students (Orhan, 2023) were found either more than moderate or high. These findings imply that the diverse participant groups have relatively high levels of NML according to recent studies.

The studies mainly investigated the variations in students' NML in terms of demographic characteristics to better understand its antecedents. Gender was one of the most commonly investigated demographic characteristics. In her study with a balanced gender distribution, Balaban-Sali (2012) determined that female university students' NML level was relatively higher than males. According to the results of the study conducted by Chandler (2013) with nearly equal gender distribution among middle schoolers in Australia, young participants are very interested in new media and there are differences in terms of gender. Similarly, Kara et al.'s (2018) study, in which the majority of the participants were female, showed that teacher candidates' NML skills vary in terms of gender, and male participants have higher NML skills than females in all indicators. Consistently, Arsenijević and Andevski (2016) revealed that the NML levels of the participants, including secondary and university students, teachers, and professors, differ depending on gender, and male participants' NML levels are higher than females' levels. Ugurhan et al. (2020) also found that the NML levels (particularly FC and CP) of open and distance learners, the majority of whom are female learners with an age range of 18 to 71, vary in terms of gender. In their study with approximately equal gender distribution, Chen et al. (2018) however, found that there is no significant difference between male and female students in terms of NML, and concluded gender equality is possible for NML. Consistently, other recent studies conducted with preservice teachers (Tuğtekin & Mercimek, 2022) and adults with the age range of 18 to 85+ (Gogus et al., 2023) indicated no gender difference in terms of NML.

Age was another demographic factor denoted as influential on NML. Balaban-Sali (2012) stated that the NML levels of university students, who are over 18 and the majority of them are in the age range of 18-27, significantly changed in terms of age, and young participants' NML levels were high. In conjunction with this finding, Arsenijević and Andevski (2016) stated that individuals' NML levels differ depending on age as a result of their study, and this is in favor of young people. Ugurhan et al. (2020) similarly found that there are significant differences between the NML skills of X and Y student generations in open and distance education in favor of the Y generation (in their study, Y refers to the age of 39 and below, and X refers to the age above 39). A more recent study conducted with a wide age

range from 18 to 85+ by Gogus et al. (2023) revealed that young adults have higher NML than older adults.

The usage purpose and intensity of new media tools were also investigated by several studies. Balaban-Sali (2012) found that the NML levels of university students who spend more time in fields such as the internet and social media are higher. Literat (2014) revealed that there is a strong relationship between individuals' NML and their new media platform usage and individuals using new media have higher NML. Yildiz Durak and Saritepeci (2019) revealed that high schoolers' social media usage intensity is negatively related to their NML while their social media usage purpose is positively related to their NML. They also point out that the use of social media with interactional and educational aims is positively related to NML. In the same vein, Barut Tugtekin and Koc (2020) illustrated that the communication skills and democratic tendencies of university students are associated with their NML. Celik et al. (2021) similarly revealed that undergraduate students' goals of social media usage, as well as epistemological beliefs, influence their NML. They also underline that social media usage for interaction purposes might enhance their NML levels.

Educational background is another topic of interest in NML studies. Arsenijević and Andevski (2016) argued that NML differs depending on the field of education, but not on the place of residence. Kara et al. (2018) concluded that pre-service teachers' NML skills differ in terms of the teacher training programs they enrolled in and that the courses in the programs, particularly ICT teacher training programs, may have an impact on prospective teachers' NML levels. Consistently, Gogus et al.'s (2023) study indicated that the participants with a higher degree of education have higher levels of NML. They found that the adults with graduate and undergraduate degrees have higher NML than the ones with high school degrees. From a pedagogical perspective, Koc and Barut (2016) argued that students should be supported in terms of critical aspects, and production and sharing features of new media. In this sense, there may be some problems with putting new media into practice for educational purposes. Udoudo and Ojo (2016) illustrated that there are differences between schools in the use of new media, so teachers should be taught in this sense and curricula should be provided with new media applications.

Based on the findings of the reviewed studies, it could be argued that the variations in students and teachers' NML are the results of the variations in their new media experience, usage purpose, and relevant knowledge and skills that can be acquired through education and training. Therefore, students' educational level and teachers' subject field as the indicators of experience and education as well as their ages might be the underlying antecedents of their NML development.

Significance and purpose of the study

In the relevant literature, it was observed that the majority of the NML studies were conducted with the participation of university students (e.g., Barut Tugtekin & Koc, 2020; Celik et al., 2021; Irmak et al., 2023; Kara et al., 2018; Luan et al., 2023) although there are rare studies including primary and high school students (Chen et al., 2018; Yildiz Durak & Saritepeci, 2019). In spite of the ongoing debate on the so-called digital native-immigrant debate (Evans & Robertson, 2020; Smith et al., 2020), the inclusion of in-service teachers in the NML studies, particularly with K-12 students, is quite limited. This study aimed to fill in this gap in the literature by including both K-12 students and teachers with a relatively large sample. It was also aimed to investigate whether the distinction between students and teachers mentioned by Prensky (2001) is still observed in the context of new media. Besides, the research efforts on the antecedents of NML are quite restricted (Celik et al., 2021). For this reason, the present study also aims to reveal the demographic factors influential on both students and teachers' NML. The findings of the study provide intervention recommendations for both of them, accordingly, and offer suggestions for educational institutions and curricula.

In this regard, the current study aims to comparatively investigate students and teachers' NML in addition to exploring the demographic antecedents. Thus, the following research questions were specifically sought to be answered:

1. What are the NML levels of students and teachers?
2. Do students and teachers' NML levels differ?
3. How do students' educational level and gender predict their NML?
   - How does gender moderate the relationship of educational level with NML?
4. How do teachers' age, subject field, and gender predict their NML?
   - How does gender moderate the relationships of these characteristics with NML?

Method

Research design

The present study employed a causal-comparative research design. It is used to investigate the already existing causes or consequences of the differences between the participant groups, and can also be viewed as associational research (Fraenkel et al., 2012). In this study, student and teacher groups were compared in terms of their NML, and then, how their NML levels were predicted by their demographics with the moderation of gender was investigated.

Participants

The participants of this study are students and teachers in a metropolitan province of Türkiye. A total of 1195 students and 581 teachers voluntarily participated in the study. Table 1 indicates the demographic characteristics of both participant groups. 246 of the teachers (42.3%) were female while 335 of them (57.7%) were male. Their ages ranged from 23 to 63. About half of the teachers were in the age range of 31-40 (N=309, 53.2%), followed by 41-50 (N=126, 21.7%), 23-30 (N=114, 19.6%), and 51-63 (N=32, 5.5%). The majority of the teacher participants' educational degree was undergraduate (83.8%) while 94 of them have a graduate degree (16.2%). On the other hand, 718 of the students (60.1%) were female while 477 of them (39.9%) were male. The majority of the participants were high school students (51.5%, age range:14-19), followed by middle school (40.8%, age range:10-14) and primary school students (7.6%, age range:6-10). The majority of the residential areas where students live were towns (43.4%), followed by city centers (31.1%) and villages (25.4%).

Data collection instrument

The data collection instrument used in this study included two parts. The first part includes the demographic information form, where the demographic characteristics of the participants such as gender, age, educational level, and subject field were collected. The second part of the questionnaire included the NML scale developed by Koc and Barut (2016) based on the NML framework proposed by Lin et al. (2013). The required validity and reliability studies were conducted by them. In the current study, the scale was separately validated for both students and teachers. The confirmatory factor analysis was

Table 1 Demographic characteristics of the participants

		Demographics	Frequency	%
Teachers	Gender	Male	335	57.7
		Female	246	42.3
		Total	*581*	*100*
	Educational Degree	Undergraduate	487	83.8
		Graduate	94	16.2
		Total	*581*	*100*
Students	Gender	Male	477	39.9
		Female	718	60.1
		Total	*1195*	*100*
	Education Level	Primary School	91	7.6
		Middle School	488	40.8
		High School	616	51.5
		Total	*1195*	*100*
	Residential Area	City Center	372	31.1
		Town	519	43.4
		Village	304	25.4
		Total	*1195*	*100*

conducted for the construct validity and revealed that the scale is valid for both students (χ^2/df=4.85, CFI=.92, AGFI=.86, SRMR=.047, RMSEA=.057) and teachers (χ^2/df=3.54, CFI=.90, AGFI=.79, SRMR=.067, RMSEA=.066) (Hu & Bentler, 1999). The Cronbach Alpha values were obtained for the students as follows: FC=.88, CC=.93, FP=.91, and CP=.91. The value obtained for the total scale for students was .97. The Cronbach Alpha values for the teachers were as follows: FC=.85, CC=.90, FP=.91, and CP=.91. The value for the total scale for teachers was obtained as .96. These findings indicate that the scale is valid and reliable for both students and teachers. The NML scale consists of four factors and 35 items in total. The scale items are categorized under four factors, entitled "Functional Consumption" (FC), "Critical Consumption" (CC), "Functional Production" (FP), and "Critical Production" (CP). The scale was used as a 5-point Likert scale.

Data collection and analysis

The questionnaire including the demographic information form and the NML scale was distributed to the participants online. The data from both students and teachers were collected in the spring semester of 2020. The online form clearly presented the aim of the study and how the collected data were to be used and protected to ensure voluntary participation. The study was approved (approval number: E.8799) by the Social Sciences Ethical Committee within the researchers' University.

Both descriptive and inferential statistical analyses were used to answer the proposed research questions. The data analysis was conducted after the data screening procedures. The outliers detected in student (N=14) and teacher (N=24) groups were excluded from the study. The inferential statistical analyses were conducted after satisfying the required assumptions. For the first research question, descriptive statistics were presented as the mean and standard deviations for both groups. The independent samples t-test and Multivariate Analysis of Variance (MANOVA) were used to answer the second research question. As for the third and fourth research questions, hierarchical multiple regression analyses were conducted. The findings were explained and presented in the form of tables.

Findings

Descriptive findings

The descriptive findings regarding the NML levels of teachers and students are shown in Table 2. The factor with the highest score in the teacher group was FC (*M*=4.20, *SD*=.50), followed by CC (*M*=4.19, *SD*=.46). The lowest score was CP (*M*=3.72, *SD*=.72), followed by FP (*M*=4.13, *SD*=.63). In the student group, CC has the highest mean score (*M*=3.84, *SD*=.76), followed by FC (*M*=3.76, *SD*=.82). The lowest mean score was gathered for CP (*M*=3.49, *SD*=.83), followed by FP (*M*=3.75, *SD*=.89).

Table 2 Descriptive findings on teachers and students' NML

	Dimensions	*M*	*SD*
Teachers	Functional Consuming	4.20	.50
	Critical Consuming	4.19	.46
	Functional Prosuming	4.13	.63
	Critical Prosuming	3.72	.72
Students	Functional Consuming	3.76	.82
	Critical Consuming	3.84	.76
	Functional Prosuming	3.75	.89
	Critical Prosuming	3.49	.83

According to the descriptive findings, teachers show higher and approximate NML levels for FC, CC, and FP while they have a relatively low level of NML for CP. Students' NML levels were relatively low compared with teachers, but they similarly demonstrated approximate levels for FC, CC, and FP while their CP skills were relatively low.

Comparison of teachers and students' new media literacy

The independent samples t-test was conducted to compare teachers and students' NML. Table 3 shows that there are significant differences between teachers and students' NML levels. It was observed that the mean scores of the teachers for all factors are significantly higher than the mean scores of the students: FC ($t_{(2\text{-}1174)}$=14.12; p<.05; d=.65), CC ($t_{(2\text{-}1774)}$=12.25; p<.05; d=.56), FP ($t_{(2\text{-}1774)}$=10.39; p<.05; d=.49), and CP ($t_{(2\text{-}1774)}$= 6.35; p<.05; d=.31). The d values indicate that the effect sizes of these differences are mainly large. These findings imply that the participant teachers' NML scores for all factors are significantly higher than the students'.

MANOVA was conducted to reveal the possible differences between teachers and student groups in terms of their educational degrees. The findings in Table 4 show that the mean scores of the teachers for all factors are higher than the mean scores of students at all levels. Teachers have higher NML than students at primary, secondary, and high school levels in terms of FC(F(3,1772)=161.12; p<.05; η^2=.21), CC(F(3,1772)=117.99; p<.05; η^2=.17), FP(F(3,1772)=127.53; p<.05; η^2=.18), and CP (F(3,1772)=94.95; p<.05; η^2=.14). It was therefore concluded that teachers demonstrate higher NML than students at all educational levels.

Table 3 Comparison of teachers and students' NML

Dimensions	Groups	N	*M*	*SD*	*t*	*df*	*p*	*Cohen's d*
Functional Consuming	Teacher	581	4.20	.50	14.12	1774	.00	.65
	Student	1195	3.76	.82				
Critical Consuming	Teacher	581	4.19	.46	12.25	1774	.00	.56
	Student	1195	3.84	.76				
Functional Prosuming	Teacher	581	4.13	.63	10.39	1774	.00	.49
	Student	1195	3.75	.89				
Critical Prosuming	Teacher	581	3.73	.72	6.35	1774	.00	.31
	Student	1195	3.49	.83				

Table 4 Comparison of teachers and students' NML in terms of educational level

Dimensions	Level	N	*M*	*SD*	*F*	*p*	*Partial Eta Squared*
Functional Consuming	Primary School	91	2.78	.78	161.12	.00	.21
	Middle School	488	3.61	.79			
	High School	616	4.02	.70			
	Teachers	581	4.20	.50			
Critical Consuming	Primary School	91	2.95	.78	117.99	.00	.17
	Middle School	488	3.79	.75			
	High School	616	4.01	.65			
	Teachers	581	4.19	.46			
Functional Prosuming	Primary School	91	2.58	.89	127.53	.00	.18
	Middle School	488	3.67	.89			
	High School	616	3.99	.74			
	Teachers	581	4.13	.63			
Critical Prosuming	Primary School	91	2.47	.76	94.95	.00	.14
	Middle School	488	3.38	.81			
	High School	616	3.72	.71			
	Teachers	581	3.73	.72			

Prediction of students' new media literacy by their educational level and gender

The hierarchical multiple linear regression analysis was conducted to reveal how students' demographic characteristics predict their NML with the inclusion of gender as the moderator. For this aim, students' educational level and gender were dummy-coded as they are categorical variables. Primary school was adopted as the reference category to create two new dummy variables [Middle School (Dummy)=1, High School (Dummy)=1] while the male was adopted as the reference category for gender (Female=1, Male=0).

Firstly, Model 1, shown in Table 5, was significant for all NML dimensions: FC [$F(2, 1192)=128.498$, $p<.05$, $R^2=.177$], CC [$F(2, 1192)=93.850$, $p<.05$, $R^2=.136$], FP [$F(2, 1192)=123.293$, $p<.05$, $R^2=.1719$], and CP [$F(2, 1192)=117.308$, $p<.05$, $R^2=.164$]. The findings further indicated that students' educational level significantly and positively predicted their NML levels. In Model 2, gender was added to the analysis as a predictor. The findings showed that the models obtained for FC [$F(3, 1191)=86.656$, $p<.05$, $R^2=.179$], CC [$F(3, 1191]=31.243$, $p<.05$, $R^2=.138$), FP [$F(3, 1191)=56.264$, $p<.05$, $R^2=.177$], and CP [$F(3, 1191)=80.151$, $p<.05$, $R^2=.168$) are significant, and likewise, students' educational levels remained significant and positive predictors ($p<.05$). Gender was also found as a significant and negative predictor of prosuming skills; FP and CP ($p<.05$), but not of consuming skills; FC and CC ($p>.05$).

Table 5 Prediction of students' NML by their educational level and gender

Predictors	Functional Consuming			Critical Consuming			Functional Prosuming			Critical Prosuming		
	B_1	B_2	B_3	B_1	B_2	B_3	B_1	B_2	B_3	B_1	B_2	B_3
Middle School (Dummy)	.50**	.50**	.49**	.55**	.54**	.53**	.60**	.61**	.61**	.54**	.54**	.54**
High School (Dummy)	.76**	.77**	.76**	.71**	.70**	.69**	.79**	.81**	.82**	.76**	.77**	.77**
Female (Gender Dummy)		-.04	-.05		.04	.04		-.07**	-.08**		-.06*	-.06**
Middle School X Gender Dummy			-.01			-.01			.04			-.00
High School X Gender Dummy			-.04			-.04			.01			-.03

Note: *p<.05, **p<.01, B_1=Model 1, B_2=Model 2, B_3=Model 3

Model 3 for all NML dimensions further demonstrates the moderator role of gender in the relationships between the students' education level and NML. The tested models were significant for all NML dimensions: FC [$F(5, 1189)=52.283$, $p<.05$, $R^2=.180$], CC [$F(5, 1189)=18.844$, $p<.05$, $R^2=.138$], FP [$F(5, 1189)=33.895$, $p<.05$, $R^2=.177$], and CP [$F(5, 1189)=48.212$, $p<.05$, $R^2=.169$]. In Model 3, students' educational level significantly predicted all NML dimensions ($p<.05$). As the reference category was primary school in the dummy coding for educational level and the obtained values were positive, it was concluded that the prediction of NML levels from primary to high school increases considering the obtained coefficients for middle and high schools. Furthermore, gender was found as a significant and negative predictor of prosuming skills: FP and CP ($p<.05$); but not of consuming skills. Since the reference category was males in the dummy-coding and the obtained values were negative, it was concluded that male students have higher NML than females in the prosuming dimensions (FP and CP). It was finally observed that gender has no moderator effect on the relationships between educational level and the NML dimensions ($p>.05$). In other saying, the prediction of students' NML levels by their educational level is not a function of their gender.

Prediction of teachers' new media literacy by their age, subject field, and gender

The hierarchical multiple linear regression analysis was conducted to reveal whether teachers' age and subject field significantly predict their NML with the inclusion of gender as the moderator. For this goal, as done for the students' data, teachers' subject field and gender were dummy-coded as they are dichotomous variables. Other subject fields were adopted as the reference category (ICT as the subject field=1, other subject fields=0) while the male was adopted as the reference category for gender (Female=1, Male=0).

The obtained findings from the three tested models were shown in Table 6. Model 1 was tested to show the prediction of the NML dimensions by the teachers' age and subject field. These models for all NML dimensions were observed as significant: FC [$F(2, 578)=18.798$, $p<.05$, $R^2=.061$], CC [$F(2, 578)=5.685$, $p<.05$, $R^2=.019$], FP [$F(2, 578)=51.151$, $p<.05$, $R^2=.150$], and CP [$F(2, 578)=20.832$, $p<.05$, $R^2=.067$]. It was further indicated that teachers' subject field was a significant and positive predictor of all NML dimensions ($p<.05$) while age only significantly and negatively predicted prosuming dimensions: FP and CP ($p<.05$). Gender was included as a predictor in Model 2. The models were significant for all NML dimensions: FC [$F(3, 577)=15.829$, $p<.05$, $R^2=.076$], CC [$F(3, 577)=4.808$, $p<.05$, $R^2=.024$], FP [$F(3, 577)=39.679$, $p<.05$, $R^2=.171$], and CP [$F(3, 577)=17.204$, $p<.05$, $R^2=.0829$]. As illustrated in Table 6, all significant predictors observed in Model 1 remained significant for all dimensions in Model 2. Additionally, gender was found as a significant and negative predictor of FC, FP, and CP ($p<.05$); but not of CC ($p>.05$).

Table 6 Prediction of teachers' NML by age, subject field, and gender

Predictors	Functional Consuming			Critical Consuming			Functional Prosuming			Critical Prosuming		
	B_1	B_2	B_3	B_1	B_2	B_3	B_1	B_2	B_3	B_1	B_2	B_3
Age	-.03	-.05	-.05	.01	.00	.00	-.16**	-.17**	-.18**	-.09*	-.10*	-.11**
ICT (Dummy)	.24**	.22**	.22**	.14**	.13**	.13**	.33**	.30**	.32**	.23**	.21**	.21**
Female (Gender Dummy)		-.13**	-.13**		-.07	-.07		-.15**	-.14**		-.12**	-.13**
Age X Gender Dummy			-.03			-.02			-.028			-.05
ICT X Gender Dummy			-.01			-.01			.054			-.01

Note: *p<.05, **p<.01, B_1=Model 1, B_2=Model 2, B_3=Model 3

Model 3 was tested to reveal the moderator influence of gender on the link between predictor variables and NML dimensions. The models obtained for all NML dimensions were significant: FC [$F(5, 575)=9.552$, $p<.05$, $R^2=.077$], CC [$F(5, 575)=2.945$, $p<.05$, $R^2=.025$], FP [$F(5, 575)=24.348$, $p<.05$, $R^2=.175$], and CP [$F(5, 575)=10.637$, $p<.05$, $R^2=.085$]. In the final model, it was revealed that teachers' age negatively and significantly predicted solely prosuming skills: FP and CP ($p<.05$). This means that as teachers get older, their prosuming literacies decrease while their consuming literacies do not significantly change across the ages. On the other hand, teachers' subject field was a significant and positive predictor of all NML dimensions ($p<.05$). As the reference category was other subjects in the dummy-coding of the subject field and the gathered coefficients were positive, it was concluded that ICT as a subject field significantly impacts teachers' NML in all dimensions. Moreover, gender significantly and negatively predicted FC, FP, and CP dimensions ($p<.05$); but not CC ($p>.05$). As the reference category was males in the dummy-coding and the gathered values were negative, it was inferred that male teachers have higher NML than females in the prosuming dimensions as well as functional consuming.

The findings from Model 3 finally demonstrated that gender has no moderator role in the relationships among the independent variables and NML dimensions ($p>.05$). This implies that the relationships among the independent variables and NML dimensions are not a function of gender.

Discussion, conclusion, and recommendations

The current study aimed to investigate students and teachers' NML levels and to reveal how their NML levels were predicted by their demographic characteristics. The descriptive findings indicated that students and teachers have NML at a relatively high level considering their mean scores for each dimension of the NML scale. This is a common finding revealed by several studies (e.g., Chen et al., 2018; Irmak et al., 2023; Kara et al., 2018; Tomczyk & Wasinski, 2017; Tuğtekin & Mercimek, 2022). It was, however, notable that both groups have lower critical prosuming skills compared with other NML dimensions. In other saying, while both groups have adequate skills in consuming and functional prosuming, they have relatively inadequate skills in critical prosuming skills such as critical participation in new media environments and the creation of media content with critical perspectives. In a similar context, Kara et al. (2018) and Koc and Barut (2016) found that the participants have the lowest skills of NML in critical prosuming while they demonstrate high skills in consuming and functional prosuming skills. In a recent study, Irmak et al. (2023) similarly revealed that pre-service teachers have the lowest NML in critical prosuming. The reason behind these findings is likely that the intensive use of mobile technologies and social networking improves both students and teachers'

consuming and functional prosuming skills (distribution and production). But, the critical participation and creation dimension of NML requires education and training on new media as its focus is on a critical understanding of participation and creation. As recommended by Irmak et al. (2023) for teacher training programs, the findings from the current study underlines the need for developing curricula for both K-12 education and pre and in-service teacher training, particularly aiming to the improvement of critical prosuming skills dimension in the NML framework.

It was secondly shown that teachers and students are different in terms of NML and teachers' NML is significantly higher than students' for all NML dimensions. Besides, teachers' NML is significantly higher than students' at all educational levels. It can be therefore clearly concluded based on the findings that today's teachers are more literate than their students in terms of the NML framework adopted in this study. Although Prensky's (2001) "digital natives" conception includes some of today's teachers, these findings showed that it is now a myth that today's students are more digitally literate than their teachers in terms of functional and critical dimensions. In spite of the ongoing digital native-immigrant debate (Evans & Robertson, 2020; Smith et al., 2020), the findings of this study revealed that the assumed difference is in favor of the teacher population. What matters and contributes to their NML is both formal (school-based) and informal experiences (online environments) of the students and teachers (Meyers et al., 2013). As Evans and Robertson (2020) argued digital native debate is now at the reconceptualization phase and the researchers are required to focus more on enablers of and barriers to the development of digital literacies, including functional and critical dimensions covered by the NML framework.

The investigation of the teachers' demographic characteristics further shed light on the development of their NML. It was revealed that the ICT as a subject field significantly predicts their NML for all dimensions than other subject fields. A partially similar finding was observed in Kara et al.'s study (2018), indicating that pre-service ICT teachers have higher scores than others in terms of some sub-dimensions of CC, FP, and CP. The reason is likely the intensive use and integration of new media tools in the ICT teacher training programs. These findings imply that, as underlined by Koc and Barut (2020), curricula of both K-12 and teacher training should be developed so that students can obtain the required knowledge and skills for NML. Several studies conducted in the same (e.g., Irmak et al., 2023) and other national contexts (e.g., Hanell, 2018; Instefjord & Munthe, 2016; Røkenes & Krumsvik, 2014) similarly imply the need for teacher training curricula emphasizing the development of digital competencies.

The findings additionally revealed other demographic antecedents of both students and teachers' NML as well as the moderator role of gender. The gender-related findings for students first indicated that male students have higher NML in prosuming dimensions

while gender has no significant influence on consuming dimensions. On the other hand, the male teachers demonstrated higher NML skills than females for prosuming dimensions and functional consuming: FP, CP, and FC. Furthermore, the investigation of the gender's moderator role in the prediction of NML dimensions demonstrated that the relationships between the antecedents and NML dimensions are not a function of gender for both students and teachers. The inconsistent findings obtained for students and teachers are likewise observed in the relevant literature. While some of the findings in the relevant literature showed that females have higher NML (Balaban-Sali, 2012), some indicated vice versa (Arsenijević & Andevski, 2016; Kara et al., 2018) as observed in the current study, and others indicated no difference (Chen et al., 2018; Gogus et al., 2023; Tuğtekin & Mercimek, 2022). Based on the findings of this study, particularly indicating that gender has no moderator influence on the NML development depending on other demographics, it could be argued in line with Chen et al.'s argument (2018) that gender equality is possible and the focus of the NML studies should be more on formal (school-based) and informal experience in new media. In other saying, NML studies are required to focus more on school-based and informal interventions for and experiences of both students and teachers as the current study revealed that they are the main contributing factors to NML development. In this sense, the integration of new media environments in school learning and teacher training such as the study by Hanell (2020) would be useful in understanding how the affordances of new media and learner views interact, in particularly development of the critical digital literacies.

As the indicators of experience, students' educational levels and teachers' ages and subject fields were included in the analysis to find out their roles in the participants' NML. As for the students, the findings showed that their NML increases for all dimensions as they move from primary to high school. This implies that as students get older or gain experience with the intensive usage of new media, their NML similarly increases. The opposite of these findings was reported in several other studies (Arsenijević & Andevski, 2016; Gogus et al., 2023; Ugurhan et al., 2020), indicating that younger participants have higher NML. The reason behind the inconsistency is likely that the participants of the prior studies include university students (Ugurhan et al., 2020) and adults (Gogus et al., 2023) since the findings from the teachers in this study demonstrated partially similar findings. It was observed that teachers' age negatively and significantly predicted solely prosuming skills: FP and CP while their age has no impact on their consuming skills: FC and CC. It was then concluded that as teachers' age increases, their NML decreases in prosuming, but not in consuming dimensions. This finding implies that while experience with new media might improve their consuming skills, the development of prosuming skills requires education and training. In line with this argument, the findings of this study also indicated that ICT as a subject field significantly contributes to the development of NML in all

dimensions. Likewise, Gogus et al. (2023) indicated that the participants' NML increases as their educational degree increases from high school to university degrees. Consequently, it is possible to conclude that the focus of NML in both K-12 and teacher training should be on the integration of new media tools into formal education and training environments as students learn new media-related skills from both classroom and extracurricular activities (Chandler, 2013). Rather than generational and gender issues, the aim should be to provide opportunities for both students and teachers to engage in new media experiences so as to improve their consuming and prosuming skills.

The present study has several limitations in nature and also recommendations for further studies on NML. The first limitation is that convenience sampling was used in the present study. Although the sample size is large enough to represent the population, the use of convenience sampling does not guarantee that the participants are the representative group of the population. For example, it is possible that tech-savvy teachers was more likely to participate in the present study than others. For this reason, future studies might be conducted for the generalizability of these findings including K-12 students, pre-service and in-service teachers. Secondly, as the data in this study were collected in the early stages of the emergency remote teaching due to the COVID-19 pandemic, future follow-up studies are highly recommended to reveal the influences of the online learning experience during the pandemic period on both students' and teachers' digital literacies, including NML. Finally, this study is descriptive in nature, and future intervention studies, particularly the ones providing formal experiences in education and training environments, are also recommended. As for the practical implications, new media should be firstly used in pre and in-service teacher training programs and improvement of teachers' NML must be a priority so that they can provide their students with formal experiences with new media in classrooms. Secondly, new media usage and NML should be an integrated part of the educational curricula to guide students' new media experience in informal environments as well as to improve their NML.

Abbreviations

NML: New Media Literacy; FC: Functional Consuming; CC: Critical Consuming; FP: Functional Prosuming; CP: Critical Prosuming; MANOVA: Multivariate Analysis of Variance.

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Authors' contributions

Both of the authors contributed to all parts of the study, including conceptualization, methodology, writing-review, and editing. The second author supervised the study in all stages. Both authors read and approved the final manuscript.

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Declarations

Competing interests
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