DEVELOPING AND VALIDATING A MEDIA LITERACY SELF-EVALUATION SCALE (MLSS) FOR ELEMENTARY SCHOOL STUDENTS

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ABSTRACT
The arrival of new media technology has the potential to radically change education. It has become important for both academics and practitioners to understand the behavioural intentions of students towards media technology. Many scales have been developed to measure the attitudes of secondary students towards the usage of media technology. However, few scales have been developed to assess media literacy in primary school students. To develop a validated scale for the media literacy of elementary school students, the Media Literacy Self-assessment Scale (MLSS) was adopted and modified in this study and then validated using a sample (N=594) of students from Taiwan. The MLSS is a two-factor scale that measures learning with media (LWM) and media communication & ethics (MCE); these components have been proposed to constitute the multidimensional constructs. A confirmatory factor analysis was performed on a proposed nine-item model of the MLSS, and it was found the model provides a good fit. Gender and grade comparisons of the results are discussed. Educational implications and suggestions for future research are also provided.
Keywords: Media Literacy Self-assessment Scale (MLSS), Scale Validation, Confirmatory Factor Analysis, Taiwanese Elementary School Students

INTRODUCTION

The influence of media technology on the social environment is ubiquitous. In today's world, media has become a way of life. The media informs us, entertains us, and connects us to the world. Recently, new technology has emerged (such as edutainment technology) and been applied in different fields (Chang, Lee, Wang, & Chen, 2010; Cheng, Wu, Liao, & Chan, 2009; Chiang, Lin, Cheng, & Liu, 2011; Lee & Chen, 2009; Lin & Liu, 2009;

Liu, in press; Liu, Cheng, Lin, Chang, & Chen, 2008; Liu & Lin, 2009; Liu, Kou, Lin, Cheng, & Chen, 2008; Liu, Lin, & Chang, 2010; Sung, Chang, & Lee, 2008). Through technology, the media is enmeshed in our daily lives. The media has the potential to shape personalities and change the way we perceive and understand the world and our immediate reality. Moreover, we have seen that a large number of people depend on the Internet to collect information, read news, listen to music, download films, play games, and complete work. In recent years, the media has become one of the most important channels for the acquisition of knowledge for children in the modern world (Bennett, Maton, & Kervin, 2008; Cabra-Torres & Marciales-Vivas, 2009; Liu & Chang, 2010; Prensky, 2001; Tapscott, 2009). Therefore, it has become important to learn how to use this powerful technology appropriately and to understand what factors affect the individual use of media technology. In the past, researchers have found that self-efficacy affects an individual's use of new technology (İşman & Çelikli, 2009; Teo, 2009; Topkaya, 2010).

Media surrounds us and is present in everything. This phenomenon has made learning easier and more interesting for children. Television, radio, computers and the Internet are gradually entering classrooms and changing the way that students learn. In particular, computers and the Internet are quickly becoming our dominant cultural tools for searching, selecting, gathering, storing, and conveying knowledge in representational forms (Covington, 2004; Jenkins, 2006; Kuiper, Volman, & Terwel, 2009). There are both advantages and disadvantages to increasing one's knowledge of the different aspects of media. As we adopt the good components of this knowledge, we should also try to avoid the bad. The negative messages disseminating through various media technologies can be avoided by developing the skills to question, evaluate and analyse these messages. Therefore, it is vital for individuals to develop media literacy so that they can make the best use of the new technology and so that they are able to interpret and process all kinds of media messages (American Library Association, 1989; Enochsson, 2005; Thoman, 2003).

Media literacy can be broadly defined as a combination of the various skills needed to search, select, analyse, evaluate, and communicate in the various forms of media (Considine, Horton, & Moorman, 2009; Enochsson, 2005; Livingston, 2004; Kuiper, Volman, & Terwel, 2009). Kuiper, Volman and Terwel (2009) identified the principal components of three forms of media literacy related to the World Wide Web: Web searching skills, Web reading skills, and Web evaluation skills. Similarly, Covington (2004) advocates the notion that media literacy involves critical viewing skills and the ability to regard, evaluate, and interpret content. Furthermore, Schaefer (2005) pointed out that media literacy is usually conceptualised as a set of skills related to the production of a media message. In sum, media literacy has been identified as an essential form of literacy by the Partnership for 21st Century Skills, and it is crucial that schools focus on helping students acquire the skills necessary to navigate, evaluate, and communicate in various kinds of media (Jenkins, 2006).

Media literacy does not simply encompass being entertained by the media; it also necessitates that one learns something from it. Furthermore, the subjects that we learn in our curricula are also found in the media. These subjects may include the arts, science, maths, different languages, social sciences and health. Media literacy may also help to develop critical thinking skills. The students are able to get a broad exposure to popular cultural references. They can gather statistics and data from the news that can then be the basis for math and science learning. Because a major part of the learning process is concentrated on children, the new media can play a significant role in satisfying their intellectual curiosity. Children often learn important things through the media, which can change their perspective on life. Teachers can also incorporate media analysis whenever the Internet, computers, television or video is used in the classroom.

Scholars have begun to conduct research that focuses on learning in media literacy education and, in particular, on the relationships between students' existing knowledge about the media and the knowledge teachers make available. Brag (2002) used her classroom observation to illustrate that what students learn and how they learn it during media literacy practice often has little relevance to their everyday media use. Caronia (2009) used conversation analysis to identify a typology of the interactions between children while they watched television in an educational context. These scholars stress the need to gather ethnographic data on the actual media experiences of students and how they perceive media literacy strategies. Erstad and Gilje (2008) explored the impact of everyday experiences with media and digital tools on the production practices of students in media education. Their survey data indicate that young people largely draw on their media experiences from outside school. Therefore, media literacy education should address the intersection between formal and informal ways of learning among youth.

Although media has been around for a long time, many administrators and teachers have just begun to hear about media literacy and to realise its importance. Because media literacy education is essential for modern citizens and is an important quality in civic society, it should begin at the earliest possible stage (i.e., during elementary

school). To equip students with the required skills, three general guidelines exist for teaching basic media literacy in K-12 (Utah State Office of Education, 2006) which are (1) Awareness: students will be aware that media literacy as a life skill is integral to modern citizenship, informed decision making, and healthy lifestyles. (2) Analysis: students will analyze elements of media messages to understand their forms and functions, content, and effects on the receiver. (3) Evaluation: students will evaluate elements and intended results of media messages to facilitate selection for personal and educational use. Chang and Liu (in press) also proposed three components of media literacy for elementary school students: (1) media application skills (students' abilities to perform media technologies), attitudes toward media (students' perceptions regarding ethics of technologies), and (3) learning with media (students' abilities to extract messages from media to perform learning tasks. Based on the review of the existing literature, there is no widely accepted instrument to assess media literacy in Taiwanese elementary school students. Therefore, the purpose of this study is to develop and validate a Media Literacy Self-assessment Scale (MLSS) for assessing the media literacy of elementary school students. According to Chang and Liu's (in press) study, media application skills and attitudes toward media are categorized as a combined dimension "media communication & ethics". Therefore, learning with media (LWM) and media communication & ethics (MCE) will be included in the developed instrument to measure students' perceptions towards media literacy. Furthermore, after validating the questionnaire, grade and gender differences were analysed.

DEVELOPMENT AND VALIDATION OF MLSS

Pilot Study

Participants

A total of 300 subjects participated in the pilot study. Subjects were recruited from five elementary schools in Taipei, Taiwan. Among the participants, 149 were female students and 151 were male students. There were 146 5th graders and 154 6th graders among the group.

Reliability and Validity of the MLSS

A pool of items was adapted from the Media Literacy Self-assessment Scale (MLSS), which was developed by Chang and Liu (in press). A total of 13 items were selected to assess each subject's cognitive response towards using media technology in learning and their behavioural attitude towards using media technology. All items were scored on a 5-point Likert scale that ranged from "strongly disagree" to "strongly agree".

The revised 13-item MLSS (See Appendix A) was given in a pilot study to 300 students who were aged 12-13. The sample was 49.7% female (n=149) and was drawn from 10 classes in 2 primary schools in Taipei, Taiwan. Each survey was administrated by the same person; the MLSS can be administered in 10 min. Participants were advised that the scale is not a test and that there are no right or wrong answers. They were asked to indicate the level of their agreement with each statement and to answer as honestly as possible. Data was analysed using SPSS 12.0 to assess the reliability and validity of the measure.

To explore the factorial structure of MLSS, we conducted exploratory factor analysis (EFA) on sample 1 (N=300) using principal axis factoring and varimax rotation (Table 1). Most researchers recommend a sample size of 100-200 cases for exploratory factor analysis (Hair, Black, Babin, Anderson, & Tatham, 2006). As such, the sample of 300 cases is more than adequate at this stage of analysis.

The overall alpha coefficient for the 13 items of MLSS was 0.9, and the coefficients for media application skills and the media communication and ethics subscales were 0.83 and 0.72, respectively. These coefficients are regarded as being acceptable for scale construction (DeVellis, 2003). To choose the number of factors, eigenvalues greater than 1 and the screen test were used as the decision criteria. There were two factors that had eigenvalues greater than 1; these factors accounted for 49.34% and 8.27% of the variance. An item was retained only when it loaded greater than 0.50 on the relevant factor and less than 0.50 on the non-relevant factors. All of the factor loadings in each factor were greater than 0.50. The first factor consisted of 6 items (m_1_b, m_2_a, m_2_b, m_1_a, m_2_d, and m_2_c with factor loadings of 0.744, 0.693, 0.679, 0.666, 0.576, and 0.513, respectively) out of the 13 MLSS items. This factor was named learning with media (the variance of this factor explained 49.34% of the total variance). The second factor consisted of 7 items (m_4_b, m_4_a, m_4_c, m_3_a, m_3_b, m_1_c, and m_3_c with factor loadings of 0.763, 0.599, 0.576, 0.544, 0.533, 0.528, and 0.522, respectively) of the MLSS; this factor was named media communication and ethics (the variance explained 8.27% of the total variance).

Table 1 Results of Exploratory Factor Analysis

Items	LWM	MCE
m_1_b	**.744**	.286
m_2_a	**.693**	.363
m_2_b	**.679**	.272
m_1_a	**.666**	.328
m_2_d	**.576**	.300
m_2_c	**.513**	.453
m_4_b	.228	**.763**
m_4_a	.387	**.599**
m_4_c	.204	**.576**
m_3_a	.442	**.544**
m_3_b	.423	**.533**
m_1_c	.418	**.528**
m_3_c	.329	**.522**
Cronbach's α	.83	.72
Eigenvalues	6.41	1.07
Cumulative of variance (%)	49.34%	57.61%

Note: LWM: learning with media; MCE: media communication and ethics

Primary Study

Student Sample

The participants in this study were elementary school students in Taiwan (5th and 6th graders), whose ages ranged from 12 to 13 years old. Over a 5-week data collection period, 900 paper-based questionnaires were distributed among three major demographic areas in northern, central, and southern Taiwan. From each area, a varied number of individual classes from several elementary schools were chosen to complete a survey.

The non-responses, unintentional skips or unidentifiable marks on some items of the survey were processed by the study as "missing data". Hence, the valid number of samples for each item or subscale of the survey varies. However, the "missing data" does not exceed 5% of the whole data set for any one item or subscale. A total of 594 usable questionnaires were returned, yielding an effective rate of 66%. Among the respondents, 301 were males and 293 were females; 259 were 5th graders and 335 were 6th graders.

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis was conducted to test a two-factor model of the MLSS, as revealed in the pilot study. It was hypothesised that confirmatory factor analysis of the MLSS would indicate that the responses to the MLSS could be explained by two factors, identified as Learning With Media (LWM) and Media Communication & Ethics (MCE). We used Lisrel8.8 with a maximum likelihood method to test our factorial validity.

We used sample 2 (N=300, randomly selected from the 594 participants) to develop a model. A variety of fit indices were used to test the model fit. An adequate model fit is represented by GFI, CFI, and NNFI values that are greater than 0.90 (Hoyle & Panter, 1995) and a RMSEA value below 0.05 (Byrne, 2001). Based on the EFA, a two-factor model result did not offer a good fit (χ^2=307.57; GFI=0.86; CFI=0.95; NNFI=0.94; SRMR=0.058; RMSEA=0.11). Next, we removed some items to improve the model fit according to the modification index. The modification index was computed using residual values. On the basis of this criterion, we deleted items from the larger MI in the CFA model. Items m-1a, m-2d, m-3b, and m-4b were removed and the fit indices (which shifted to χ^2=54.34; GFI=0.96; CFI=0.99; NNFI=0.98; SRMR=0.037; RMSEA=0.06) fit the data well.

In this study, we employed sample 3 (N=294, selected from the 594 participants after removing the 300 participants used in sample 2) to further demonstrate a two-factor CFA model. After deleting 4 items of the MLSS in sample 2, a two-factor CFA model was also reliable. The results showed a satisfactory fit to the data (χ^2=63.52; GFI=0.95; CFI=0.98; NNFI=0.97; SRMR=0.038; RMSEA=0.07). These results indicated that our two-factor model had a good fit to the other sample set.

We next used a competitive model approach to determine the model that best fit the theory. Following that, the convergent validity, discriminate validity, composite reliability and item reliability will be shown below.

Model Competition

In this stage, in addition to our hypothesis model (first-order, two-factor oblique model), we used an independent model and a first-order, two-factor orthogonal model as alternative models. Table 2 presents the independent

model that had the worst fit indices. Compared to the independent model, the first-order, two-factor oblique model and the first-order, two-factor orthogonal models are significant improvements. Specifically, the first-order, two-factor oblique model exhibits the best fit to the data. Because the high-order models did not converge, this result indicates that the first-order, two-factor oblique model fits the data best.

Table 2 The Results of Model Comparisons

Fit indices	χ^2(df)	χ^2/df	RMSEA	GFI	AGFI	CFI	NNFI	SRMR
Independent model	1974.02(36)	54.83						
First-order, two-factor orthogonal model	198.65(27)	7.35	.15	.87	78	88	85	.27
First-order, two-factor oblique model	63.52(26)	2.44	.070	.95	.92	.98	.97	.038

In a second stage, we further compared the independent model to the one-factor model and the two-factor model (Table 3). Specifically, the one-factor model allowed all of the items of the MLSS to load on one factor. The two-factor model with the items assigned to the two corresponding variables. Results showed that the two-factor model yielded a better fit (χ^2=129.99, p<0.001, df=98, χ^2/df=1.32, RMSEA=0.047, GFI=0.90, CFI=0.95, NNFI=0.93, SRMR= 0.07), and the $\Delta\chi^2$ was also significant.

Table 3 Results of Different Factor Structure of Models

Fit indices	χ^2(df)	χ^2/df	$\Delta\chi^2$	RMSEA	GFI	AGFI	CFI	NNFI	SRMR
independent model	1974.02(36)	54.83							
one-factor model	82.14(27)	3.04	1891.88*	.083	.94	.90	.97	.96	.046
two-factor model	63.52(26)	2.44	18.62*	.070	.95	.92	.98	.97	.038

In conclusion, through the two-stage competitive model, we found that the two-factor oblique model had a better fit to the theory according to the dimension of learning with media (LWM) and media communication and ethics (MCE).

Convergent Validity

The results of our two-factor CFA model are presented in Table 4. All of the factor loadings from the items to their latent factors were significant, and the composite reliabilities were all above 0.60. These results provide evidence for the convergent validity of our scale.

Table 4 Results of Convergent Validity of MLSS

Factors	items		Standard solution	R^2	S.E.	C.R.	Composite reliability	AVE
Learning with media (LWM)	m_1_b I understand how to operate media technology devices.	.62	.68	.46	.05	12.35	.83	.50
	m_1_c I can select appropriate types of media based on my learning needs.	.67	.60	.36	.06	10.67		
	m_2_a I am familiar with the operational functions of media equipment that is used to broadcast learning content.	.74	.78	.61	.05	15.06		
	m_2_b I use different media technology to store/backup learning content.	.76	.78	.60	.05	14.91		
	m_2_c I use media for my learning tasks.	.71	.67	.44	.06	12.11		
Media	m_3_a I understand the content that is conveyed by media.	.64	.66	.44	.06	11.64	.75	.42
	m_3_c	.68	.64	.41	.06	11.17		

communication and ethics (MCE)	I discuss the displayed contents of media with others. m_4_a					
	I possess an accurate understanding of media use. m_4_c	.61	.67	.45	.05	11.86
	I comply with the intellectual property rights of media use.	.59	.63	.39	.05	10.85

We followed the procedures proposed by Anderson and Gerbing (1988). Discriminant validity was established using chi-square difference tests to compare an unconstrained measurement model with a constrained model (in which the correlations between two latent factors are set equal to one). Table 5 indicates that the $\Delta\chi 2$ was significant and that two factors can be discriminated in our scale.

Table 5 Result of Discriminant Validity

Variable	model	χ2	DF	Δχ2
MLSS	unconstrained model	63.52	26	
	constrained model	198.65	27	135.13***

Student Scores on the Scale

Table 6 indicates the average item scores and the standard deviations on the two subscales of the MLSS. Students scored highest on the media communication & ethics subscale (with an average score of 4.23 per item), followed by the learning with media subscale (with an average score of 4.21 per item). The standard deviations of both two subscales are moderate and the students' scores are close to each other. The results indicate that, on average, the students demonstrated essential media literacy in a technology-enriched learning environment.

Table 6 Students' Score on the MLSS Subscales (N=300)

Subscale	Items	Mean	SD
LWM	5	4.21	0.75
MCE	4	4.23	0.70

Gender Differences on the Scale

This study further compares the scores of the male and female students on the two subscales of the MLSS. The results of independent t tests are presented in Table 7, revealing that these gender scores on both subscales were significantly different at the 0.05 level. Female students expressed more positive perceptions of learning with media and of media communications & ethics. In other words, the male students perceived they were less media literate.

Table 7 Gender Comparisons on the Subscales of the MLSS

Subscale	Gender	Mean	SD	t
LWM	female	4.38	.60	2.66**
	male	4.17	.72	
MCE	female	4.30	.67	2.54*
	male	4.08	.85	

Note: N= 149 for female; N=151 for male; *p<0.05, **p< 0.01

Grade Comparisons on the Scale

To examine the possible effects of grade level, this study also compared the score of the fifth and sixth graders on the two subscales of the MLSS. In general, the latter group scored higher on the two subscales (LWM and MCE) than did the former. However, the results of independent t tests revealed that both fifth and sixth graders perceived similar levels of competency on each subscale (Table 8). Overall, comparisons of the MLSS scores indicated that students at the advanced grade level did not necessarily rate themselves higher in media literacy.

Table 8 Grade Comparisons on Subscales of the MLSS

Subscale	Grader	Mean	SD	t
LWM	5th	4.25	.70	-.50
	6th	4.29	.64	
MCE	5th	4.15	.76	-.88
	6th	4.23	.78	

Note: N = 146 for the 5th graders; N =154 for the 6th graders; *p < 0.05

DISCUSSION AND CONCLUSIONS

To encourage high-quality research, to enable integration and consistency across research studies, and to increase our understanding of media literacy, there is a need for a valid and reliable measure of the media literacy construct. This study completes an exploratory-confirmatory research cycle by more rigorously validating the MLSS. Completing this cycle is important because it required an added precision in the model specification. From the above analysis, a two-factor, nine-item instrument with good psychometric properties for measuring the media literacy of elementary school students was developed. This study presented an empirically validated model to measure the media literacy of elementary school students. The nine-item MLSS instrument that emerged was demonstrated to produce acceptable reliability estimates, and the empirical evidence supported its content validity, discriminant validity, and convergent validity. Therefore, this revision of the MLSS instrument can be utilised to assess the media literacy of elementary school students.

The results of this study revealed that female students tend to be more media literate than their male counterparts for the 5th and 6th grades elementary students. This result is inconsistent with previous studies (Chang, 2008; Lee & Yuan, 2010; Liu & Lin, 2010; Tsai, Lin, & Tsai, 2001; Yen & Lee, 2011) that examined gender differences in technology-related attitudes, which have generally indicated that male students held more positive attitudes towards technology than did female students. There are several possible explanations for the superior media literacy of the female students. First, boys may spend more time outdoors with their peers, playing sports and hanging out (Lemish, Liebes, & Seidman, 2001), whereas females spend more time reading, writing and listening to music (Trainor, Delfabbro, Anderson, & Winefield, 2010). Second, girls may use media in more diverse ways, spreading their literate activities over the different modalities (Unlusoy, de Haan, Leseman, & van Kruistum, 2010), whereas boys may still be more focused on related new technology such as mobile devices (Yen & Lee, 2011). Finally, male students may view technology as a playful toy, whereas female students may treat it as a tool to accomplish a task (Lee & Yuan, 2010). Therefore, girls may demonstrate a higher level of engagement in media literacy, allowing them to outscore boys on both subscales of the MLSS. The media literacy practices of girls, who may seem to be in a disadvantaged position in relation to new media, are put in a different light when their use of new media is placed within the broader spectrum of media use. Consequently, educators should take gender differences into consideration when developing media instructional activities. For example, robotics may be integrated into learning activities to promote male engagement in media literacy (Liu, 2010).

With regard to grade level, both fifth and sixth graders acquired similar levels of knowledge and skills and had similar attitudes and perceptions towards media literacy. Accordingly, grade (or age) differences were not determining factors of this ability. In general, higher grade students are more media literate than lower grade students. However, it seems not so trivial or irreverent in our case. One possible explanation for this result is that both fifth and sixth graders had similar experiences about using media and they were just one grade difference. For example, they have to understand the basic operations of word processing software in their computer classes. Future studies may compare students with a larger grade difference to see if the result is still the same.

This study presents a convenient tool to assess the perceptions towards media literacy of elementary school students, based on learning with media and media communication & ethics. Using this tool, teacher educators and researchers can more deeply explore the role that views about media literacy plays for elementary school students. Even though the rigorous validation procedure allows us to develop a general instrument for measuring media literacy, this work has some limitations that could be addressed in the future. First, while the valid instrument was developed using sample data gathered in Taiwan, a cross-culture validation (using another large sample gathered elsewhere) would be required for further generalisation of the instrument. Additionally, the sampling method has potential bias, as a sample of willing respondents may not generalise to the population of all students. Consequently, other samples from different areas or nations should be gathered to confirm and refine the factor structure of the MLSS instrument and to assess its reliability and validity.

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Appendix A
Items of the MLSS

Coding	Item
m-1-a	I can understand different types of media (e.g. visual media, audio media) and their principles.
m-1-b	I can understand how to operate media.
m-1-c	I can understand the content that media convey.
m-2-a	I can be familiar with the operational functions of media equipment to broadcast the learning content.
m-2-b	I can use different media technologies to store/backup the content.
m-2-c	I can discuss with others the content that media display.
m-2-d	I can select appropriate media to edit the messages that I want to convey.
m-3-a	I can use media to carry out daily learning.
m-3-b	I can use media appropriately to convey ideas (e.g. use a camera to record events).
m_3_c	I discuss the displayed contents of media with others.
m-4-a	I possess the accurate understanding of media use.
m-4-b	I can cherish and conserve media equipment.
m-4-c	I can comply with the intellectual property rights of media use.