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Teachers' ICT Literacy in the Contemporary Primary Classroom: Transposing the Discourse

Eva Dakich

eva.dakich@research.vu.edu.au

School of Education

Faculty of Arts, Education and Human Development

Victoria University

Abstract

What should teachers know about teaching and learning with ICT? How can they effectively integrate ICT and their pedagogical practices in order to improve student learning and engagement?

This paper provides insight into research findings of a survey study that validated a framework of ICT literacy for teaching and learning in the primary classroom. Developed by an international Delphi panel, the framework identifies four dimensions of teachers' ICT literacy: Operational Understanding and Application of ICT, ICT-Rich Pedagogies and Learning Environments, ICT for Professional Learning and Engagement, and The Social Ecology of Living and Learning with ICT.

Primary school teachers from a random sample of 350 Victorian state primary schools were invited to participate in the survey, and validate the findings of the Delphi process, by rating the importance of each individual teacher capability included in the Framework of ICT Literacy for Primary School Teachers.

The paper compares the findings emerging from the Delphi process and the survey study, and discusses similarities and differences of opinion between the Delphi panel and a representative sample of the teacher community.

Keywords: ICT literacy, teacher capabilities, ICT-rich pedagogies

Introduction

Information and Communication Technologies (ICT) have been infused into schools without fundamentally changing the way we learn and teach (Bigum, 1992; Papert, 1995; White, 2005). In most cases they were simply adapted to traditional school structures, classroom organization and existing teaching practices (Anderson & Becker, 2001; Watson, 2001), failing to address comprehensive educational reform (Earle, 2002; Fullan, 1993).

It took considerable time, to realize that technology itself will not revolutionize education (Cuban 2000; 2001; Rogers, 2001), and to understand that one of the most significant barriers to successful integration of ICT and transformation of learning have been teachers' lack of confidence, experience, and pedagogical understanding in mobilizing the potential of digital technologies (Becker & Riel, 2001; Dale, Robertson, & Shortis, 2004).

Due to global implications related to this problem, empowering teachers with pertinent ICT skills and knowledge has become an important issue engaging various stakeholders such as policy makers, researchers, and practitioners in the field of learning and teaching with ICT.

Numerous studies have been conducted (Burke, 1998; Finger, Lang, Proctor, & Watson, 2004; Scheffler, 1999), international, national, and state level frameworks have been created, with the aim to identify ICT skills and competencies for teachers (Becta, 2003; DE&T, 1998; DEST, 2002; ISTE, 2000). The focus has slowly shifted from a technocratic definition of functional computer skills towards a more contemporary view of multiliteracies, embracing not only the operational but the cultural, critical and human aspects of using ICT (Lankshear, Snyder, & Green, 2000; O'Rourke, 2005).

This paper contributes to the discourse on teachers' ICT literacy by providing insight into the findings of a recent survey study that validated a framework of ICT literacy for primary school teachers developed by an international Delphi Panel. Furthermore, it compares the findings emerging from the Delphi process and the survey study, and discusses similarities and differences of opinion between the Delphi panel and a representative sample of teachers teaching in Victorian state primary schools. Both studies are part of a current PhD research entitled: From ICT Competencies to the Social Practice of ICT-Rich Pedagogies.

Study design

Method and aims

A medium-scale, descriptive survey method (Best & Kahn, 1998; Cohen, Manion, & Morrison, 2000) was implemented, the aim of which was to validate a newly developed framework of ICT literacy for primary school teachers. The framework consisted of 37 teacher capabilities that were also used by teachers for rating their own ICT literacy. These findings will be reported in future publications.

Survey instrument development

The Framework of ICT Literacy for Primary School Teachers was developed in 2003/2004, by an international panel of ten experts, utilizing the Delphi method (Dakich, 2004). The members of the Delphi panel were selected based on their expertise in ICT and innovative pedagogies by an Advisory and Monitoring Team. The panel included primary school teachers, technology coordinators, educational researchers and teacher educators. The four-round Delphi process identified four major dimensions of ICT literacy (Figure 1), and generated 37 teacher capabilities, presented in Table 1, pp 9-11.

Following the conclusion of the Delphi process the framework was transformed into an online teacher survey. The survey consisted of nine demographic items, 37 teacher capabilities, and two open-ended questions. The aim of the survey was to collect data from primary school teachers teaching in Victorian state primary schools. Prior to implementation, the survey instrument was tested for validity and reliability. Content validity, criterion-related validity, construct validity (Creswell, 2005; Utts, 2005) were established through stages of instrument development, expert review and pilot study.

The 37 items belonging to the Framework of ICT Literacy for Primary School Teachers were checked for internal consistency following both the Delphi process and the survey study. The Cronbach's reliability index for the Delphi process was $\alpha = 0.952$, and for the survey study $\alpha = 0.966$.

Survey participants

Primary school teachers from 350 randomly selected state primary schools, representing all nine Victorian school regions, were invited to participate in the online survey that concluded in July 2005. A total of 124 valid responses were obtained. Analysis of demographic data shows that 54.05% responses were submitted by teachers teaching in the metropolitan area. Details about the distribution of responses by school regions are presented in Figure 1¹.

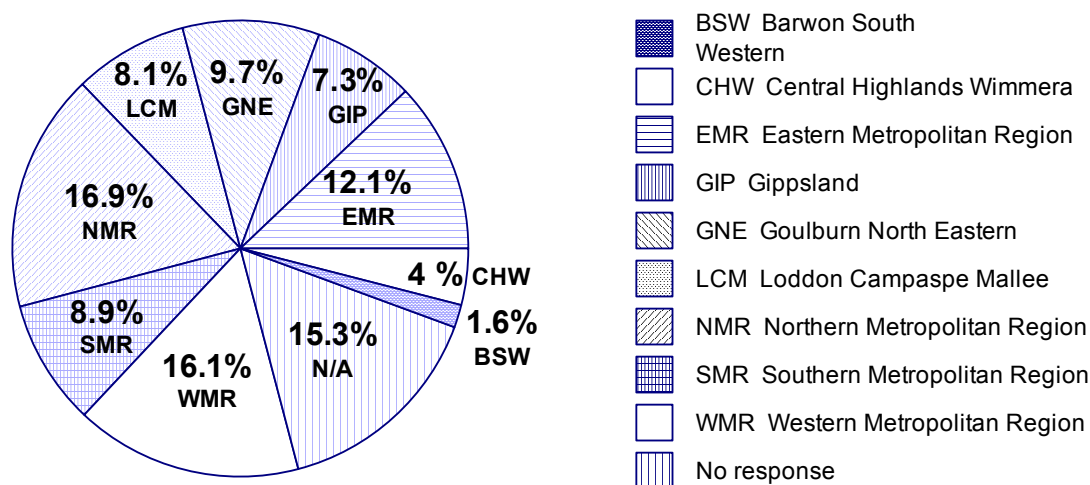


Figure 1: Distribution of responses by school regions.

It is interesting to mention that while the survey instrument was available online, more than third (36.3%) of the survey participants chose to submit their responses by traditional mail.

¹ No response refers to 15.3% of the survey participants who chose not to identify the school region they belonged to.

Findings and discussion

The framework of ICT literacy generated by the Delphi panel includes four dimensions of teachers' ICT literacy: Operational Understanding and Application of ICT, ICT-Rich Pedagogies and Learning Environments, ICT for Professional Learning and Engagement, and The Social Ecology of Living and Learning with ICT, as presented by the dynamic model in Figure 2.

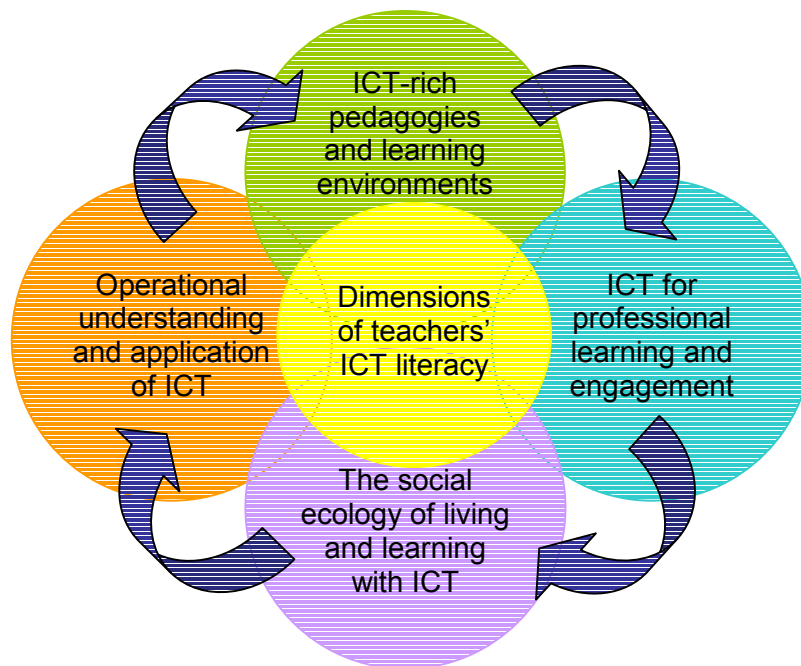


Figure 2: The four dimensions of teachers' ICT Literacy

As part of the validation process, primary school teachers participating in the online survey study were requested to rate the importance of each of the 37 teacher capabilities, using a four-point Likert-type scale. The values of the scale were: Not important - 0, Somewhat important - 1, Important - 2, Very important - 3. The same scale was utilized in the Delphi process to assist the panel in the selection of the 37 items from a larger pool of teacher capabilities. In both studies a mean value of 2 (indicating important) was considered to be the cut-off point for inclusion of teacher capabilities into the framework of ICT literacy. Due to a different sample size, teacher capabilities having a mean value less than 2 were not considered to be important in the Delphi study, while findings of the survey study suggested that teacher capabilities significantly less than two were not considered to be important by teachers. Significance was calculated in SPSS, utilizing the single sample t-test. The means and standard deviations for both the Delphi panel and participants of the teacher survey are presented in Table 1, pp 9-11.

The following section provides an insight into the findings of the Delphi process and the survey study. It discusses similarities and differences of opinion with regards to each dimension of teachers' ICT literacy and individual teacher capabilities between the Delphi panel and a representative sample of primary school teachers teaching in Victorian state schools.

Dimension 1: **Operational Understanding and Application of Information and Communication Technologies**

Dimension 1 consists of four capabilities that refer to teachers' operational understanding and application of ICT, such as: having up-to date understanding of ICT used in school, workplace, home and community; demonstrating professional judgment and skill in the selection and application of common computer software and hardware, as well as demonstrating familiarity and utilization of network resources for communication and research purposes.

All four capabilities were validated by the teachers. Comparison of importance rankings of teacher capabilities based on the calculation of mean values and standard deviation, tells us that the Delphi panel considered having an up to date contextual understanding of ICT to be the most important teacher capability in this group (C1), while being skilled in the application of common computer software and utilizing networks (C3, C4) was of the highest importance for the teachers. The largest discrepancy of opinions appears to be related to utilizing network resources to communicate, conduct research and exchange ideas (C4), which was considered to be of much higher importance by the teachers than the Delphi panel.

Dimension 2: **ICT- Rich Pedagogies and Learning Environments**

Dimension 2 comprises of 20 teachers capabilities. These capabilities describe teaching practices, and ICT-rich pedagogies that are embedded in the pedagogical rationale of constructivist learning environments (Jonassen, 1999; Papert, 1997; Sharp, 2002; Taylor, 1999), and connected communities of learners (Siemens, 2004). The emphasis is on innovative and integrated approaches to learning and teaching with ICT, where the role of the teacher is to design, facilitate and scaffold student enquiry, by making informed choices about the relevance and responsiveness of ICT-rich learning experiences to the diverse needs of learners, and the context of living and learning in the contemporary world.

Data analysis suggests agreement between Delphi panellists and survey participants that the most important capability for primary school teachers is to ensure that students develop competence, confidence, and critical awareness in using ICT (C20). Both groups acknowledge that teachers' ability to plan for the effective management and application of ICT resources to create learner-centred environments is vital to successful ICT integration (C5). Neither the Delphi panel nor the teachers consider using ICT to support monitoring, assessment and evaluation strategies (C24) to be among the capabilities of higher importance.

With regards to differences, teachers place more emphasis on making informed decisions about the relevance of educational software (C7); using technology to design and present units of work and prepare handouts (C12); and differentiating between applications of ICT that support routine tasks and higher order cognitive skills (C11). On the other hand Delphi panellists place more importance on promoting inclusive, student-centered learning and constructivist learning environments, such as: making informed decisions about the relevance of ICT applications to particular learning outcomes (C10); understanding and responding to the diverse needs of

learners by choosing and designing inclusive pedagogical strategies and practices supported by ICT (C9); applying ICT-rich curricular activities to facilitate enquiry, problem solving, critical thinking and knowledge construction (C13); as well as extending students' ability to evaluate assess, and monitor their own work by creating digital projects, electronic portfolios, etc. (C23).

According to descriptive statistical analysis of sample means, three teacher capabilities were not considered to be important by the majority of teachers:

- C17 Explores innovative uses of ICT, such as being connected across multiple dimensions: local and global communication.
- C18 Facilitates on-line communication and collaboration of students at a local and global level.
- C19 Encourages students to become members of local and extended communities of learning.

Further statistical analysis, utilizing a single sample t-test, was conducted to determine the statistical significance of the deviation of sample means of the above capabilities from the known test value (2=important). The results of the t-test indicate that only teacher capabilities C18 and C19 had a significantly different mean from the test value. Consequently, teacher capabilities C18 and C19 were not validated by the random sample of primary school teachers.

Dimension 3: **ICT for Professional Learning and Engagement**

The eight teacher capabilities belonging to this dimension are descriptors of ICT-rich practices and approaches related to professional learning and engagement.

There is a strong emphasis on developing critical consciousness about how ICT can be integrated into everyday professional practices, to assist and facilitate professional inquiry, continuous learning, collaboration and connectedness with the local and global community. There is also a focus on critical understanding of how the integration of ICT can influence the restructuring and reorganization of classrooms and schools for improved student learning.

Both Teachers and Delphi panellists consider sharing and discussing effective practices with other teachers and participating in collaborative projects (C31) as moderately important for successful integration of ICT into learning and teaching. Both groups have a similar view about the importance of using technology to research and extend curriculum options (C26), as well as using ICT to communicate with parents, colleagues and the larger community (C29).

Differences in opinion indicate that teachers find it more important than the panellists to engage in ongoing professional development related to the integration of ICT in order to support student learning (C30, ranked by the teachers as the fourth most important capability in the framework of ICT literacy). Panellists however emphasize the importance of demonstrating continual growth in understanding and applying ICT to educational settings, and keeping abreast of current and emerging technologies and pedagogical approaches (C28).

Capabilities referring to planning for continuous professional development related to ICT-rich pedagogies (C27), as well as conducting professional enquiry using current

literature and research on ICT-rich pedagogies (C25) were considered of lesser importance by the majority of teachers participating in the survey. The single sample t-test confirmed that teacher capability C25 had a mean value significantly less than two; hence it was not validated by the random sample of primary school teachers.

Dimension 4: **The Social Ecology of Living and Learning with ICT**

This dimension of teachers ICT literacy addresses the social ecology of integrating ICT into everyday practices. It has a strong focus on developing and implementing conscious strategies that address equity, inclusion, and ethical conduct (embracing moral and legal aspects), as well as health and safety related issues when integrating ICT into learning and teaching. It also promotes the need for teachers to be familiar with recreational uses of ICT and its role in youth culture.

The application of ethical positions and responsible behaviours associated with the use of ICT, such as network/Internet policies, copyright laws and intellectual property, has been ranked as the second most important aspect of teachers ICT literacy by the teachers (C35). Also the need for developing and consciously implementing strategies to address issues related to equity and inclusion (C33) was considered to be of high importance by the participants of the teacher survey.

Demonstrating familiarity with the role of technology in youth culture and recreational uses of ICT (C34) was not considered important by the majority of survey participants. However the single sample t-test suggests that this teacher capability can be considered validated, since the deviation from the arbitrary mean (2) is not significant.

Limitations of the study

The response rate may limit the generalizability of the survey findings to the target population of all primary school teachers teaching in Victorian state primary schools, or other similar populations or settings.

Conclusions

This paper provided an insight into the validation of a new framework of ICT literacy for primary school teachers (Dakich, 2004). The framework of ICT literacy including 37 teacher capabilities was developed in a four-round Delphi process, by an international panel, consisting of primary school teachers, technology coordinators, educational researchers and teacher educators, with expertise in ICT and innovative pedagogies. Teachers from a random sample of 350 state primary schools across Victoria, were invited to validate the framework.

The validation process revealed similarities and differences of opinion between the Delphi panel and the teachers about the importance of individual teacher capabilities for integrating ICT into teaching and learning. Teachers confirmed the importance of 34 out of the 37 teacher capabilities belonging to the framework of ICT literacy. The

following three teacher capabilities were not validated by the participants of the teacher survey:

- C18 Facilitates on-line communication and collaboration of students at a local and global level.
- C19 Encourages students to become members of local and extended communities of learning.
- C25 Conducts professional enquiry using current literature and research on ICT pedagogies, when planning learning experiences and activities.

Further comparative analysis of findings revealed that participants of the teacher survey and the Delphi panel agreed about the utmost importance of ensuring that students develop competence, confidence, and critical awareness in using ICT. Similarly, both groups acknowledged the high importance of teachers' ability to plan for the effective management and application of ICT resources to create learner-centered environments.

Delphi panellists in general rated higher teacher capabilities that emphasize the importance of contextual awareness and critical consciousness related to ICT integration. Additionally, they placed more importance on creating inclusive, engaging learning environments that provide the learner with more autonomy. In contrast, surveyed teachers considered more important teacher capabilities that addressed the foundational dimension of ICT integration (O'Rourke, 2005), characterized by practical consciousness (Giddens, 1984).

Teacher capabilities referring to continuous professional development, as well as sharing effective practices with colleagues were highly rated by the participants of the teacher survey. However, capabilities promoting more self-directed approaches to professional development, such as developing personal plans, or conducting inquiry using current literature and research on ICT pedagogies, were not considered important by the teachers. This is in correspondence with the findings of Demetriadis et al. (2003) about teachers willing to engage in professional learning related to ICT, but always within the context of the school culture .

Contrary to the findings of Scheffler and Logan study (Scheffler, 1999), most capabilities related to socio-cultural, ethical, legal, health and safety-related issues to the use of ICT received equally high ratings from both the Delphi panel and the participants of the teacher survey. Yet, being familiar with the role of technology in youth culture, and recreational uses of ICT was considered of lesser importance by the teachers.

Comparison of findings emerging from the Delphi process and the survey study reflect differences between contemporary pedagogical thinking and current social practices related to the integration of ICT into learning and teaching. They highlight possible areas for engaging teachers in professional development that will embrace a more holistic approach to ICT integration, placing teaching and learning in the complex local and global structures of socio-cultural reality, and provide the "actors of the schools of future" (McCluskey, 2003) with more agency to seamlessly integrate ICT into their everyday practices.

Table 1

Framework of ICT Literacy for Teaching in the Primary Classroom

D1	Operational Understanding and Application of Information and Communication Technologies	Delphi Process			Survey Study		
		Rank	Mean	SD	Rank	Mean	SD
C1	Demonstrates up to date understanding and knowledge of Information and Communication Technologies (ICT) used in home, school, workplace and community.	4	2.63	0.48	10	2.38	0.77
C2	Demonstrates professional judgment in the selection and application of common computer hardware, including peripheral devices (e.g.: keyboards, printers, scanners, digital video cameras, digital microscopes, electronic whiteboards etc.).	22	2.25	0.43	24	2.18	0.88
C3	Demonstrates skill in the use and application of common computer software (e.g.: word processing, text and image editing, data and file management, graphics and design, multi- and hypermedia, etc.).	23	2.25	0.83	5	2.47	0.69
C4	Utilizes network resources such as the Internet, Intranets and Local Area Networks to communicate, conduct research and exchange ideas.	36	2.00	0.87	9	2.39	0.77

D2	ICT-Rich Pedagogies and Learning Environments	Delphi Process			Survey Study		
		Rank	Mean	SD	Rank	Mean	SD
C5	Plans for the effective management / application of ICT resources to create learner-centered environments.	5	2.63	0.7	6	2.46	0.73
C6	Makes informed choices in the selection and application of appropriate hardware to suit the needs of the learners and the context of learning.	10	2.50	0.5	18	2.30	0.89
C7	Makes informed decisions about the relevance and educational value of software, based on professional principles related to student learning, teaching goals, authentic curriculum design and technological infrastructure, by relying on existing professional competence, collaboration with colleagues, educational websites and relevant literature.	16	2.38	0.48	3	2.49	0.71
C8	Designs and integrates ICT-enhanced learning experiences across the curriculum.	11	2.5	0.71	8	2.40	0.76
C9	Understands and supports the diverse needs of learners by choosing and designing inclusive pedagogical strategies and practices supported by ICT.	6	2.63	0.48	14	2.34	0.77
C10	Makes informed decisions about the relevance and usefulness of ICT applications to meet particular learning outcomes.	1	2.75	0.43	11	2.38	0.69

C11	Differentiates between applications of ICT that support routine tasks; and those that require higher order cognitive skills; problem solving and collaboration; and applies them to appropriate learning activities and situations.	24	2.25	0.83	15	2.33	0.76
C12	Uses technology to design and present units of work and prepare handouts.	37	2.00	0.71	20	2.28	0.81
C13	Applies ICT-enriched curricular activities to facilitate enquiry, problem solving, critical thinking and knowledge construction.	7	2.63	0.48	21	2.27	0.75
C14	Integrates ICT into a range of learning activities to facilitate both individual and collaborative work.	17	2.38	0.70	13	2.34	0.76
C15	Supports inter-/multidisciplinary curricular activities with ICT.	18	2.38	0.48	26	2.13	0.75
C16	Promotes innovative uses of technology amongst students, encouraging creativity and originality.	8	2.63	0.48	12	2.36	0.80
C17	Explores innovative uses of ICT, such as being connected across multiple dimensions: local and global communication.	25	2.25	0.66	33	1.93	0.89
C18	Facilitates on-line communication and collaboration of students at a local and global level.	9	2.63	0.48	36	1.76	0.87
C19	Encourages students to become members of local and extended communities of learning.	31	2.13	0.78	37	1.68	0.89
C20	Ensures that students develop competence, confidence, and critical awareness in using ICT.	2	2.75	0.43	1	2.56	0.63
C21	Communicates with parents about ICT and curriculum, as well as about appropriate and balanced use of computers at home.	32	2.13	0.93	29	2.06	0.80
C22	Critically reflects on these experiences, and designs plans based on professional inquiry for improved student learning and innovative learning environments.	26	2.25	0.83	31	2.03	0.83
C23	Extends students' ability to evaluate, assess and monitor their own work (e.g.: by creating digital projects, electronic portfolios, etc.).	3	2.75	0.66	23	2.20	0.84
C24	Uses information and communication technologies to support the implementation of a variety of monitoring, assessment and evaluation strategies.	27	2.25	0.66	27	2.12	0.80

		Delphi Process			Survey Study		
D3	ICT for Professional Learning and Engagement	Rank	Mean	SD	Rank	Mean	SD
C25	Conducts professional enquiry using current literature and research on ICT pedagogies, when planning learning experiences and activities.	33	2.13	0.60	35	1.82	0.85

C26	Uses technology to research and extend curriculum options.	34	2.13	0.60	22	2.21	0.77
C27	Develops a personal plan for continuous professional learning related to ICT pedagogies.	19	2.38	0.48	32	1.95	0.79
C28	Demonstrates continual growth in understanding and applying ICT to educational settings, by keeping abreast of current and emerging technologies and pedagogical approaches.	12	2.50	0.5	25	2.14	0.79
C29	Uses technology to communicate ideas and collaborate with parents, colleagues, and larger community.	35	2.13	0.33	30	2.05	0.87
C30	Engages in ongoing professional development related to integration of ICT to support student learning.	28	2.25	0.43	4	2.48	0.68
C31	Shares, discusses and evaluates effective practices and strategies with other teachers, and participates in collaborative projects for designing ICT- rich learning environments.	20	2.38	0.70	19	2.29	0.78
C32	Demonstrates understanding of how the integration of ICT can influence the restructuring/ reorganization of classrooms and schools for improved student learning.	29	2.25	0.83	28	2.09	0.81

D4	The Social Ecology of Living and Learning with ICT	Delphi Process			Survey Study		
		Rank	Mean	SD	Rank	Mean	SD
C33	Develops and consciously implements strategies to address equity issues related to equal access for all students, including different levels of ability, race, gender, socioeconomic status, language and culture.	13	2.5	0.5	7	2.40	0.73
C34	Demonstrates familiarity with the role of technology in youth culture and recreational uses of ICT.	14	2.38	0.70	34	1.93	0.86
C35	Applies appropriate ethical positions and responsible behaviours associated with the use of ICT, such as network/Internet policies, copyright laws and intellectual property.	21	2.5	0.5	2	2.50	0.76
C36	Maintains a critically reflective approach in the use of electronic information in relation to vulnerability of children/youth culture to misinformation, marketing, inappropriate relationships, etc.	15	2.5	0.71	17	2.32	0.85
C37	Identifies health hazards related to the use of ICT and creates a safe learning environment that complies with basic ergonomic and health principles (including position, light, radiation, etc.).	30	2.25	0.66	16	2.33	0.79

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