CHAPTER 4

Contextual framework

4.1 Overview

This chapter describes the contextual information collected during ICILS 2018 in order to aid understanding of variation in the primary outcome achievement measures of the study: students' computer and information literacy (CIL) and computational thinking (CT). Throughout this chapter, the abbreviation CIL/CT has been used where each of CIL and CT may be considered as an outcome measure potentially influenced by a given set of contextual information. We provide a classification of contextual factors that accords with the multilevel structure inherent in the process of student CIL/CT learning, and consider the relationship of these factors to the learning process (antecedents or processes). We also list the different kinds of variables that will be collected via the different ICILS 2018 contextual instruments and briefly outline prior findings from educational research in order to explain why these variables are included in ICILS 2018.

4.2 Classification of contextual factors

When studying student outcomes related to CIL/CT, it is important to set these in the context of the different factors influencing them. Students acquire competencies in this area through a variety of activities and experiences at the different levels of their education and through different processes in school and out of school. It is also likely, as Ainley et al. (2009) argued, that students' out-of-school experiences of using ICT influence their learning approaches in school. Contextual variables can also be classified according to their measurement characteristics, namely, factual (e.g., age), attitudinal (e.g., enjoyment of computer use), and behavioral (e.g., frequency of computer use).

Different conceptual frameworks for analyzing educational outcomes frequently point out the multilevel structure inherent in the processes that influence student learning (see, for example, Gerick et al. 2017; Hatlevik et al. 2015; Schulz et al. 2016; Vanderlinde et al. 2014). The learning of individual students is set in the overlapping contexts of school learning and out-of-school learning, both of which are embedded in the context of the wider community that comprises local, national, supranational, and international contexts. As for ICILS 2013, the contextual framework of ICILS distinguishes the following levels:

- *Wider community*: This level describes the wider context in which CIL/CT learning takes place. It comprises local community contexts (e.g., remoteness and access to internet facilities), as well as characteristics of the education system and country. Furthermore, it encompasses the global context, a factor widely enhanced by access to the internet.
- *Schools and classrooms:* This context encompasses all school-related factors. Given the cross-curricular nature of CIL/CT learning, it is not useful to distinguish between classroom level and school level.
- *Home environment:* This context relates to the student's background characteristics, especially in terms of the learning processes associated with family, home, and other immediate out-of-school contexts.
- *The individual:* This context includes the characteristics of the student, the processes of learning, and the student's level of CIL/CT.

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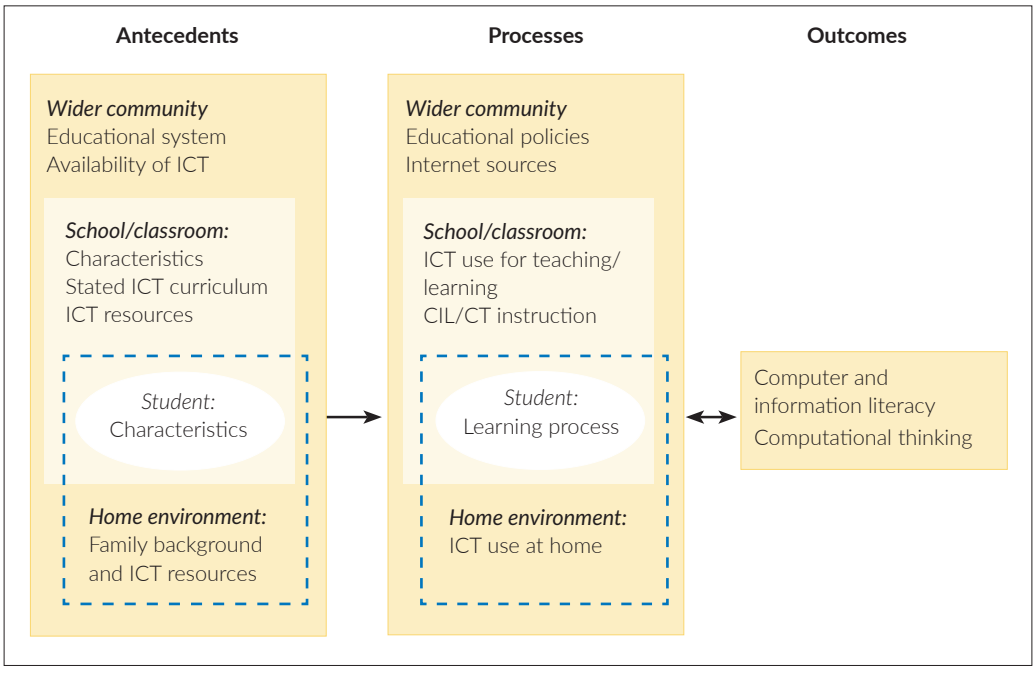
The status of contextual factors within the learning process is also important. Factors can be classified either as antecedents or processes:

- Antecedents are exogenous factors that condition the ways in which CIL/CT learning takes place. They are contextual factors that are not directly influenced by learning-process variables or outcomes. It is important to recognize that antecedent variables are level specific and may be influenced by antecedents and processes found at higher levels, for example, the extent to which schools' ICT resources are likely to be influenced by ICT education policies at the level of the education system.
- Processes are those factors that directly influence CIL/CT learning. They are constrained by antecedent factors and factors found at higher levels. This category contains variables such as opportunities for CIL/CT learning during class, teacher attitudes toward using ICT for study tasks, and students' use of computers at home.

Both antecedents and processes need to be taken into account when explaining variation in CIL learning outcomes. Whereas antecedent factors shape and constrain the development of CIL, process factors can be influenced by the level of (existing) CIL learning. For example, the level and scope of classroom exercises using ICT generally depend on the existing CIL-related proficiency of the students.

In the basic classification of antecedent and process-related contextual factors in their relationship with CIL/CT outcomes located at the different levels, each type of factor at each level is accompanied by examples of variables that have the potential to influence learning processes and outcomes (Figure 4.1). It is important to note that there is a reciprocal association between learning processes and learning outcomes while there is a unidirectional influence between antecedents and processes.

Figure 4.1: Contexts for ICILS 2018 CIL/CT learning outcomes



Notes: The double arrow between process-related factors and outcomes emphasizes the possibility of a reciprocal association between learning processes and learning outcomes. The single-headed arrow between antecedents and processes indicates the assumption within the ICILS contextual framework of a unidirectional influence between these two types of contextual factors.

Reference to this general conceptual framework enables potential contextual factors to be located on a two-by-four grid, where antecedents and processes constitute the columns and the four levels the rows (Table 4.1 shows examples of the contextual variables collected by the ICILS 2018 instruments). The student questionnaire will primarily collect data on contextual factors pertaining to the level of the individual student and his or her home context. The teacher, school principal, and ICT coordinator questionnaires are designed to locate contextual factors associated with the school/classroom level, while the national contexts survey and other available sources (e.g., published statistics) will gather contextual data at the level of the wider community.

Table 4.1: Mapping of variables to contextual framework (examples)

Level of ...	Antecedents	Processes
Wider community	**NCS & other sources:** Structure of education Accessibilty of ICT	**NCS & other sources:** Role of ICT in curriculum
School/classroom	**PrQ, ICQ, & TQ:** School characteristics ICT resources	**PrQ, ICQ, TQ and StQ:** ICT use in teaching and learning CIL/CT instruction
Student	**StQ:** Gender Age	**StQ:** ICT activities Use of ICT CIL/CT
Home environment	**StQ:** Parent socioeconomic status ICT resources	**StQ:** Learning about ICT at home

Notes: NCS = national contexts survey; PrQ = principal questionnaire; ICQ = ICT coordinator questionnaire; TQ = teacher questionnaire; StQ = student questionnaire.

4.3 Contextual levels and variables

4.3.1 The wider community context

Levels within the wider community context all have the potential to affect student learning at school or at home. Conceptually, this context has several levels:

- *Local communities*, where remoteness and lack of stable and fast internet connections may affect conditions for ICT use
- *Regional and national contexts*, where communication infrastructure, educational structures, curricula, and general economic/social factors may be of importance
- *Supranational or even international contexts*, where a long-term perspective brings in, for example, factors such as the general advance of ICT on a worldwide scale.

The most important factors potentially explaining variation in CIL/CT are located at the national level (or subnational level in those instances of sub-regions participating in the study). There is evidence of broad differences across countries in terms of access to digital technology across Europe, as well as more broadly across the world (Fraillon et al. 2014; Pew Research Center 2015; World Bank 2016).

Information relating to the contexts of educational systems will primarily be sourced from the ICILS 2018 national contexts survey, and supplemented by information from external databases and other published sources. Typically, these published sources provide information about antecedent country-context variables, while the national contexts survey will deliver data on antecedent and process variables at the education-system level.

More specifically, the national contexts survey is designed to collect systemic data on the following:

- Structure and makeup of the educational system (with specific focus on the target grade)
- Educational policy and practice in CIL/CT education (including curriculum approaches to CIL and CT)
- Policies and practices for developing the CIL/CT expertise of teachers
- Current debates on and reforms to the implementation of digital technology in schools (including approaches to the assessment of CIL/CT and the provision of ICT resources in schools)
- Information about ICT-based learning and administrative management systems.

Antecedent variables at the level of the wider community

International comparative research shows relatively strong associations between the general socioeconomic development of countries and student learning outcomes. ICILS 2018 will therefore select national (and where appropriate possible subnational) indicators related to general human development status as regularly reported by the United Nations Development Programme (UNDP 2016). Examples of these indicators are gross domestic product per person, access to education, and health statistics.

Given ICILS' focus on students' CIL/CT, it is important to take into account the general availability of and infrastructure for ICT. To this end, ICILS 2018 will collect, with the aim of describing the general ICT-related resources at the national level, information relating to variables such as the proportion of the population with access to the internet.

One example of a published source of data regarding national contexts is the ICT Development Index (IDI), developed by the International Telecommunications Union (ITU 2017). The IDI combines 11 indicators into a single measure that can be used as an index of ICT development for 154 countries or used as separate indicators. Another index is the Networked Readiness Index (see, for example, Dutta and Mia 2011).

Data from a range of international surveys show that the provision of ICT resources in schools varies widely across countries (see, for example, Anderson and Ainley 2010; Fraillon et al. 2014; Pelgrum and Doornekamp 2009). In order to obtain information related to the general policies regarding the ICT resourcing of schools, the ICILS 2018 national contexts survey will collect data about approaches to the provision of school-based ICT infrastructure, hardware, and software, as well as policy expectations regarding these provisions.

These system-level data will be complemented by school-level information from the ICT coordinator questionnaire, which will collect information about indicators such as the number of computers per student, software licensing arrangements, and the availability of digital curriculum resources.

The national contexts survey will also gather data about a range of other characteristics of the education systems participating in ICILS 2018. System-level variables related to this aspect include length of schooling, age-grade profiles, and structure of school education (e.g., study programs, public/private management), as well as the degree of autonomy of educational providers.

Process-related variables

The process-related variables on CIL/CT-related education policy that will be collected by the ICILS 2018 national contexts survey include:

- The definition of and the priority that each country gives to CIL education in its educational policy and provision
- Reforms in the use of ICT in education

- The emphasis on CIL/CT learning in the curriculum
- Support by education authorities for teacher professional learning in CIL/CT education
- The influence of different institutions or groups on decisions relating to those goals and aims.

Because the initial ICILS 2013 contextual framework references policies and practices developed as outcomes of earlier large-scale surveys of ICT in education, ICILS 2018 also considers the data relating to students' learning contexts and learning processes that were included in the reports and databases from these studies. These studies include IEA's Second Information Technology in Education Study (SITES) (Plomp et al. 2009), the European Commission's Indicators of ICT in Primary and Secondary Education (Pelgrum and Doornekamp 2009), and the International Experiences with Technology in Education survey, which covered policies and experiences in 21 countries (Bakia et al. 2011).

The information from these studies shows that countries take different approaches to the implementation of CIL/CT education in their curricula. Some education systems include it as a subject within the curriculum, whereas others include it by integrating it into other subjects. The explicitness with which countries describe their CIL/CT curricula and the learning outcomes they want from them also vary across education systems. Some have very explicit curricula regarding CIL education and its expected learning outcomes; others describe CIL/CT education as an "implicit" curriculum that weaves through the curriculum documents for other learning areas.

In order to build on what is already known, the national contexts survey will gather data on the inclusion of CIL/CT education (as a separate subject, integrated into different subjects, or as a cross-curricular approach) in the formal curriculum at different stages of schooling and in different study programs. It will also capture the nomenclature for CIL/CT-related curriculum subjects and whether they are compulsory or optional in each program of study. There will also be specific questions regarding the target grade in terms of curriculum emphasis on CIL/CT education.

Another important process-related variable at the system level is the development of teacher expertise in ICT-related teaching and learning (Charalambos and Glass 2007; Law et al. 2008; Scherer and Siddiq 2015). Teacher education programs often provide aspiring teachers with opportunities to develop ICT-related competencies. To aid assessment of the variety of different approaches to teacher education in the field, the national contexts survey gathers (where applicable) data on ICT-related requirements for becoming a teacher. The survey also seeks out information on the extent to which ICT-related education is part of preservice or initial teacher education, on the availability of in-service or continuing professional development for the use of ICT in education, on the providers of these activities, and on expectations for teachers' ongoing learning about developments in CIL/CT education.

Over the past few decades, many education systems have undertaken reforms involving the expansion in the use of digital technology in education[4]. A key feature of most national plans over the most recent decade is that they aspire to use ICT to transform patterns of learning and teaching, and also to develop capabilities useful within modern economies, rather than simply improve existing practice. However, results from ICILS 2013 suggested that participating countries differ in the extent to which they have introduced, or are introducing, digital technology into school education, including the development of curriculum resources in the form of digital learning objects (Fraillon et al. 2014). Similarly, ICILS 2013 found there was also variation in how education systems assessed ICT-related learning outcomes and in whether they used ICT to assess other disciplines. The ICILS 2018 national contexts survey will therefore gather data about the priorities accorded to these aspects and the nature of corresponding debates about related policies.

4 Two recent examples include the Slovak Republic's program for the "digitalization of the system of education" (Slovak Republic Ministry of Education 2013) and Lithuania's "Strategy on ICT integration into general and vocational education" (2008–2012) (Lithuanian Education and Science Ministry 2011).

4.3.2 School/classroom context

Any study of students' acquisition of CIL/CT must acknowledge the key role that school and classroom contexts play in that acquisition. Use of ICT is increasingly becoming standard practice in education and is therefore an important part of preparing young people for participation in modern society. Factors associated with the school and classroom context will be collected through the teacher, school principal, and ICT coordinator questionnaires. In addition, the student questionnaire includes some questions gauging student perceptions about classroom practices related to ICT. Even though ICILS 2018 will not attempt to investigate the relationship between ICT use in schools or classrooms and achievement in academic learning areas such as language, mathematics, or science, it is of interest to note the evidence of a positive impact of ICT use on classroom achievement in a meta-analysis conducted by Tamin et al. (2011).

Antecedent variables at the school/classroom level

In line with the need to consider basic school characteristics in the analysis of variations in CIL/CT, the school principal questionnaire will collect information on student enrollment, teachers, the range of grades, and the location of each participating school. It will also collect data on school management (public or private). Because, as noted earlier, ICT-related resources at school can be regarded as an important contextual factor to consider when studying students' CIL/CT, the school principal questionnaire will furthermore ask who, in the school, assumes responsibilities for the acquisition of ICT resources.

School-level factors related to ICT resourcing and priorities are known to influence both the way in which teachers use ICT for teaching and learning, and students' ICT-related learning (Fraillon et al. 2014; Gerick et al. 2017). The ICILS questionnaire for each school's ICT coordinator includes questions on the availability of school-owned computing devices at school, their location within the school, how many students have access to them, and the number of years the school has been using ICT. The instrument will also collect data on the support the school provides for ICT use in teaching and learning in terms of personnel and technology or software resources. It additionally includes a question measuring the coordinator's perceptions of the adequacy of the ICT on hand for learning and teaching at school. Analysis of this type of information will support evaluation of the premise that students in those schools with the highest levels of digital resourcing will have greater experience of and access to the use of CIL/CT, and consequently develop higher levels of CIL/CT.

With regard to school-level antecedent variables potentially influencing the development of students' CT skills, school ICT-coordinators are asked whether their school offers a stand-alone computing subject for the target grade, and, if so, to which extent this subject emphasizes a range of activities directly related to CT (e.g., activities such as developing algorithms, or debugging computer code).

The background and experiences of teaching staff potentially influence the acquisition of students' CIL/CT. Teachers' sense of self-efficacy in the use of basic ICT has been reported as linked to greater use of ICT in the classroom (Hatlevik 2016; Law et al. 2008). In ICILS 2013, teacher ICT self-efficacy was the teacher-level variable that showed the strongest association with teachers' reported emphasis on developing students CIL, and "teachers who were confident about their own ICT capability were more likely than their less-confident colleagues to place a greater degree of emphasis on developing their students' ICT-related skills" (Fraillon et al. 2014, p. 217). Furthermore ICILS 2013 reported that "older teachers typically held less positive views than younger teachers about using ICT and expressed lower confidence in their ability to use ICT in their teaching practice" (Fraillon et al. 2014, p. 257).The ICILS 2018 teacher questionnaire will therefore collect information on the background of teaching staff (such as age, gender, subject taught at school) and on their ICT experience (number of years using ICT for teaching purposes, general use of computers at different locations, participation in ICT-related professional development activities, and perceived self-confidence in using ICT for different tasks).

Teachers will also be asked to give their views on the positive and negative consequences of using ICT for teaching and learning, and to identify any factors that they think impede the use of ICT for teaching and learning at their school. Results from ICILS 2013 indicated that teachers across participating countries tended to recognize positive benefits from using ICT in teaching (Fraillon et al. 2014).

SITES 2006 findings suggested that ICT use by science and mathematics teachers is influenced by the school principal's views about its value, as well as the ICT-related support teachers have at hand (Law et al. 2008). Findings also indicated that ICT-related teaching and learning can be constrained or facilitated by the school's stated curriculum and its policies with regard to ICT. The ICILS school principal questionnaire will therefore collect data on the following factors:

- The extent to which the school has policies and procedures relating to ICT use
- The extent to which the school prioritizes ICT acquisition and resourcing
- Perception of the importance ascribed to ICT use in teaching at the school
- School-level expectations for teachers' knowledge of and skills in using ICT
- The extent to which teachers participate in ICT-related professional development.

Process-related variables at the school/classroom level

The emergence of ICT in school education has, for some time, been seen as having the potential to influence teaching and learning processes by enabling wider access to a range of resources, allowing greater power to analyze and transform information, and providing enhanced capacities to present information in different forms. The evolution of greater interactivity in more recent technologies (sometimes referred to as Web 2.0) has expanded these possibilities considerably (Greenhow et al. 2009). These developments have led to claims by some scholars that it is now possible for students to participate in extended projects that help to develop sophisticated concepts and skills through the use of simulation and visualization tools (Dede 2007). Commentators also argue that students can collaborate in developing learning experiences, generating knowledge, and sharing perspectives on experiences with other students.

The aforementioned large-scale cross-national studies also show that schools and classrooms vary in the extent to which educators use ICT in teaching. Burbules (2007) argued that, although e-learning technologies have the potential to bring transformative effects to classrooms, their implementation has been, for various reasons, surprisingly limited (see also Cuban 2001). The ICILS 2018 teacher questionnaire accordingly asks teachers to consider one of their classes (specified in the questionnaire) and to identify (where applicable) the types of ICT applications used in that class, the type of and extent to which ICT is used as part of teaching practices and for particular learning activities in that class, and the emphasis placed on developing ICT-based student capabilities. Based on research suggesting the benefits of a collaborative teaching approach on teacher self-efficacy and use of ICT for classroom purposes (see, for example, Caspersen and Raaen 2014), the questionnaire also asks teachers about their perceptions of whether and how ICT is used as part of collaborative teaching and learning at their school.

Actual student use of ICT in the learning process is another important factor. A segment of the teacher questionnaire therefore asks teachers to report on student involvement in different learning activities involving ICT use. The student questionnaire also asks students to report on how often they use computers at school, their use of computers for different school-related purposes, and the frequency with which they use ICT in their learning of different subjects. Furthermore, ICILS 2018 asks students about the frequency with which they use different ICT tools (such as tutorial, word processing, or presentation software) in the classroom, and how often activities involving the use of ICT take place during lessons (such as students using digital devices for presentations, or teachers using digital devices to provide feedback to students).

To assess how much students perceive they have learned about ICT use, ICILS 2018 contains a question that is similar to one used in ICILS 2013. This question measures the extent to

which students think they have learned at school about different ICT-related tasks (such as providing internet sources or looking for different types of digital information on the internet). In response to the ever-increasing need to educate students about online safety and security issues (Ranguelov 2010; UNESCO 2014), ICILS 2018 also contains a new question on whether students believe they have learned at school about the importance of tasks related to security and privacy when using digital devices (such as checking the origin of emails before opening them, or using social media responsibly).

As part of the CT option, an additional set of questions was included in each of the student and teacher questionnaires to collect data on the degree to which instruction relating to the skills that underpin CT takes place in classrooms. These questions address process-related context factors that may influence the development of CT skills.

4.3.3 Home context

Antecedent variables related to the home environment

The influence of student home background on students' acquisition of knowledge has been shown in many studies, and there is evidence that home background is associated with the learning of ICT skills (ACARA 2015; Nasah et al. 2010; US Department of Education, National Center for Education Statistics 2016). Influences that have been shown to be associated include parental socioeconomic status, language used at home, ethnicity, and whether or not the student and/or his or her parents have an immigrant background.

A large body of literature shows the influence of students' socioeconomic background on student achievement in a variety of learning areas (see, for example, Saha 1997; Sirin 2005; US Department of Education, National Center for Education Statistics 2016; Woessmann 2004). ICILS 2013 results showed that, in participating countries, socioeconomic background consistently explained considerable variation in students' CIL (Fraillon et al. 2014). To assess the socioeconomic status of the students' parents, ICILS 2018 will include questions on the highest educational levels of parents, their occupations, and the number of books at home. This procedure is the same as was used successfully in ICILS 2013.

In the questionnaire, the highest educational levels achieved by the student's mother and father are defined in accordance with ISCED (UNESCO 2011). The occupation of each parent will be recorded through open-ended questions, with occupations classified according to the International Standard Classification of Occupations (ISCO) framework (ILO [International Labour Organisation] 2007) and then scored using the International Socioeconomic Index (SEI) of occupational status (Ganzeboom et al. 1992). Home literacy resources are measured through a question asking students to report the approximate numbers of books at home.

There is evidence from many countries of considerable disparities in students' access to digital resources in homes, and researchers and commentators claim that these disparities affect the opportunities that students have to develop the capabilities required for living in modern societies (Warschauer and Matuchniak 2010). ICILS 2013 provided evidence for these claims in many participating countries, however, in some highly developed countries only small effects were observed (Fraillon et al. 2014). The student questionnaire gathers information about the digital resources in students' homes and uses these data to examine the relationship between resource levels and CIL. In order to take into account changes in technology and use of digital devices, the set of items for measuring digital home resources has been broadened and includes both tablet devices and e-readers.

Many studies have found that the cultural and language background of students can be associated with their educational performance (see, for example, Mullis et al. 2017; OECD 2016c; Schulz et al. 2017). To measure these aspects of student background, the ICILS student questionnaire includes questions about students' and parents' country of birth, as well as about the language which is spoken most frequently at home.

Process-related variables related to the home environment

Home environment factors that potentially influence the learning process include the use of ICT in the home context and learning through interaction with family members. The student questionnaire therefore includes questions about the extent to which students have learned about different aspects of ICT use from family and/or friends, and how often they use ICT at outside of school (including at home).

4.3.4 Individual context

Antecedent variables at the individual level

Antecedent variables at the level of the individual student consist of basic background characteristics that may influence students' CIL-related knowledge and skills. Relevant factors in this category are age, gender, and educational aspirations.

Students' knowledge and skills in different learning areas tend to increase with age. However, cross-national data from grade-based surveys tend to find negative associations between age and achievement within a given grade-level within some countries (see, for example, Schulz et al. 2017, p. 63). Findings from ICILS 2013 (Fraillon et al. 2014) showed a similar negative association which could be due to retention and progression policies where older students in the same grade (grade 8 for ICILS) are also those with lower achievement.

Studies on educational achievement in numerous learning areas have found considerable differences between gender groups. In particular, cross-national research on reading literacy has shown larger gender differences in favor of females (Mullis et al. 2017; OECD 2016c). Males have traditionally tended to be somewhat more proficient in mathematics and science, but there is some evidence of a declining or non-existent gap at present (Martin et al. 2016; Mullis et al. 2016; OECD 2016c). Data reported from Australian and US national assessments of ICT-related skills show significantly higher levels of achievement for female students when compared to male students (ACARA 2015; US Department of Education, National Center for Education Statistics 2016). Cross-national results from ICILS 2013 also indicated that female students tended to have higher levels of CIL than their male counterparts (Fraillon et al. 2014). With regard to CT skills, however, some research suggests that the opposite relationship may be expected (Atmatzidou and Demetriadis 2016).

Individual aspirations with regard to education provide an indication of students' belief in their capacity to succeed in education and should be taken into account during any analysis of variation in students' CIL/CT. ICILS 2013 results showed that students who expected to complete a university degree also had higher levels of CIL (Fraillon et al. 2014). The ICILS 2018 student questionnaire includes the same question as in the previous cycle to gauge students' expected highest level of educational qualification.

Process-related variables at the individual level

Process-related variables at the individual level in this context include attitudinal, as well as behavioral factors. An individual's self-beliefs regarding their own ability with respect to a certain learning area are often viewed as central to the process of learning, and are likely to have a reciprocal association with knowledge and skills (see for example, Schöber et al. 2018; Talsma et al. 2018). Furthermore, it is also important to include student perceptions about responsible and appropriate use of ICT, which can also be seen as intended learning outcomes from teaching CIL and CT. Behavioral variables also relate to using ICT for different purposes and needs, especially in terms of the potential that frequent and varied use of these tools has for facilitating student learning.

The student questionnaire includes items designed to measure the extent to which students express confidence in doing a range of ICT-related tasks. According to Bandura (1993), students' confidence in their ability to carry out specific tasks in an area (self-efficacy) is strongly associated

with their performance, as well as perseverance, emotions, and later study or career choices. Moos and Azevedo (2009) concluded from their review of research on computer self-efficacy that this variable plays an integral role in learning in computer-based learning environments. The two authors examined factors related to computer self-efficacy and the relationships between computer self-efficacy, learning outcomes, and learning processes. They found a number of positive associations between behavioral and psychological factors, and computer self-efficacy. A particular finding was that students who experience behavioral modeling also report significantly higher computer self-efficacy than do students who experience more traditional instruction methods.

In ICILS 2013, two dimensions of self-efficacy were identified, one related to student confidence in undertaking basic ICT tasks (such as searching and finding a file on a computer) and another one reflecting confidence in more advanced tasks (such as creating a database, computer program or macro) (Schulz and Friedman 2015). While self-efficacy related to basic tasks tended to be positively correlated with CIL, confidence in undertaking advanced tasks was not consistently associated with students' CIL (Fraillon et al. 2014). The ICILS 2018 includes a modified set of items measuring both student confidence in basic and more advanced ICT tasks that will be analyzed with regard to CIL/CT achievement.

Applying ICT for different purposes on a regular basis has considerable potential to increase knowledge and skills in this area (see, for example, ACARA 2015; Fletcher et al. 2012; US Department of Education, National Center for Education Statistics 2016), and ICILS 2013 showed frequent use of ICT for a wide range of activities (Fraillon et al. 2014). The ICILS 2018 student questionnaire consequently includes questions (modified from the previous cycle) about the frequency of using different ICT applications, using the internet for social communication, and using ICT for recreational (leisure) activities.

Data from other studies suggest a positive association between attitudes towards using ICT and academic achievement (Petko et al. 2016). In ICILS 2018, the student questionnaire includes a series of questions on students' perceptions of the impact on ICT on society and whether they intend to use ICT in the future for work and study purposes.

To gauge the educational context for the acquisition of CT skills, the ICILS 2018 student questionnaire asks students whether they study a CT-related subject (e.g., computing, computer science, information technology, informatics, or similar) in their current school year. This question is part of the international CT option.