



## **Teacher agency and learner agency in teaching and learning a new school subject, Leaving Certificate Computer Science, in Ireland: Considerations for teacher education**

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# **Teacher agency and learner agency in teaching and learning a new school subject, Leaving Certificate Computer Science, in Ireland: Considerations for teacher education**

**Abstract:** A new school subject, Leaving Certificate Computer Science, was introduced in September 2018 into Irish schools in a period of curriculum reform and change. Drawing on concepts of teacher agency and learner agency, and viewed through a figurational sociology lens, this paper explored the realities of teaching LCCS and the role teacher agency and learner agency played in such enactment. Through a case study design, four teachers were interviewed in a focus group semi-structured manner. To delve deeper into the pedagogical approaches used in LCCS, a further one teacher and their nine students were interviewed. The findings highlight an influential relationship (positive and negative, encouraging and discouraging) between teachers' agentic decisions in their process of achieving teacher agency and the students process of achieving learner agency. The paper offers a figurational viewpoint of the relationship between teacher agency and learner agency through a constructed Figure. We explicitly argue that the responsibility should not be placed on the teacher and student in achieving agency (as a product) but it is a combination of the teacher and the students *and* the other interdependent relationships within their figurations, alongside contextual factors, and educational social processes, which determine the fluctuation of the process of *achieving* teacher and learner agency. The paper provides considerations for computer science teacher education.

**Keywords:** Improving classroom teaching; Pedagogical issues; Secondary education; Teaching/learning strategies

## **1.1 Introduction**

In Ireland, Senior Cycle Reform began in 2016 with the aim of reviewing the Senior Cycle structure and purposes, and specifically, the Leaving Certificate examinations (i.e., terminal examinations after two years of education) (National Council for Curriculum and Assessment (NCCA), 2018). In the Irish schooling system, Senior Cycle is the final two-years of post-primary school when students are typically aged 15-18 years old. As part of this reform, 'new' subjects were introduced into the Senior Cycle curriculum, for example, Leaving Certificate

Physical Education, Leaving Certificate Politics and Society, and Leaving Certificate Computer Science (LCCS). Each of these subjects were constructed in a learning outcomes design, and reflected the international curriculum development trend of engaging with the ‘learnification’ of education (Biesta, 2009; NCCA, 2009). With specific reference to this paper, the LCCS specification is crucial to the realisation of the STEM Education in the Irish School System report (Department of Education and Skills, 2016). The introduction of computer science (CS) at Senior Cycle aims to change the way Irish schools approach computing and information technology (IT); replacing the idea of IT literacy and passive consumption of technology to understanding the how, where and why in regard to computing science. The LCCS specification (NCCA, 2017) fosters creativity and problem solving as well as independent and collaborative work. As with all the ‘new’ Leaving Certificate subjects, the LCCS learning outcomes are aligned with the vision and principles of Senior Cycle curriculum, promoting a balance between knowledge and skills, and aiming to develop learning strategies relevant to young people and the future which they embark upon.

In many cases, the intended learning outcomes encourage the use of learning strategies or pedagogical approaches, for example, student-centred pedagogies, which are not commonly used in teaching Leaving Certificate subjects; Leaving Certificate ‘teaching’ is more familiar with rote learning. In saying that, international research highlights how the CS post-primary teaching community possesses a rich collection of distributed practical knowledge consisting of individual teachers’ expertise regarding pedagogy (Haberman, 2006). Professional development, tailored to teachers knowledge, is important to consider as new CS curriculum is introduced (Goode, Margolis, & Chapman 2014.) 40 schools were chosen as part of a phased rollout of the subject in Ireland and these teachers are enrolled in an extensive national continuing professional development (CPD) programme to upskill teachers in computer science, Figure 1, creating CS professional development for “pedagogical content knowledge, active learning, collective participation, coherence and duration” (PDST 2017, p. 7). The CPD programme was evaluated by LERO (2020) and it is noteworthy to mention there is no reference to agency in the report.

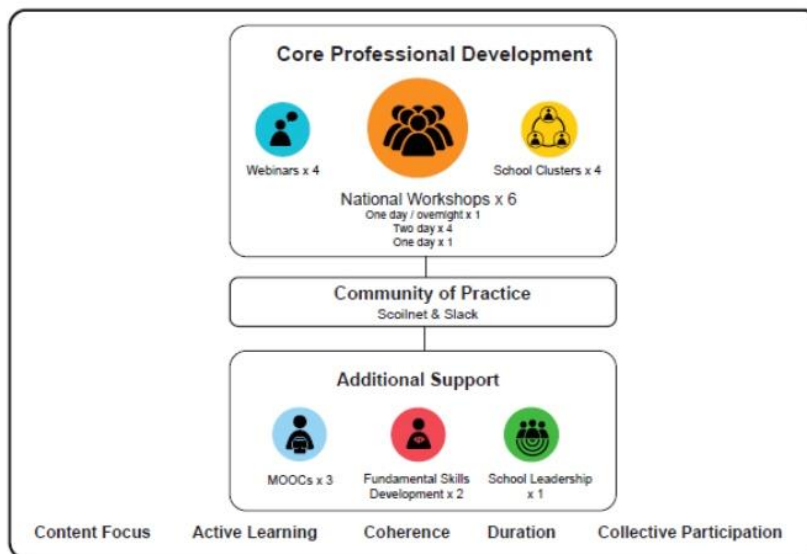


Figure 1 PDST CPD framework for LCCS (PDST 2017, p. 28)

Returning to Senior Cycle Reform in Ireland, informed by the language of learning (Biesta, 2009; NCCA, 2009), the NCCA promote the teacher as ‘key agents of change’ in curriculum development (NCCA, 2009). The notion of ‘teacher agency’ (Priestley, Biesta, & Robinson, 2013) is centralised within this conceptualisation. While the conceptualisation of teachers as key agents of change advocates a relationship between curriculum and teacher agency, learner agency (Manyukhina & Wyse, 2019) does not appear to be afforded the same space. To clarify, we refer to the post-primary students as the learners in the concept ‘learner agency’. Manyukhina and Wyse’s (2019, p.234) recent research explored the influential relationship between learner agency and curriculum content, and highlighted the need for more empirical work on learner agency and “how it is influenced by various aspects of [the] educational context”. To further explore the relationship between teacher agency and learner agency, we will draw on figurational sociology. Figurational sociology encourages us to explore actions and structures through the concept of a ‘figuration’ which is a network of interdependent people (Elias, 1978); this will be further explained later in the paper. Informed by previous research, our two research questions are as follows: 1. How does teacher agency and learner agency play a role in the enactment of a new school subject (LCCS)?; And 2. To what extent does figurational sociology help explain the relational manner between teacher agency and learner agency? The paper begins by outlining the learning outcomes based LCCS specification before discussing teacher agency and learner agency.

## 1.2 LCCS specification

The construction of learning outcomes in curriculum development is a complex non-linear interacting system. In the development of the CS specification, the design of the specification was used as the lens through which teachers, learners, and parents interpret the relationship between curriculum pedagogy and assessment (Lysaght, Scully, Murchan, O’Leary & Shiel, 2019). The NCCA Development Group’s, i.e., the curriculum makers and developers, process of defining and describing the learning outcomes was iterative and complex, working collaboratively to finalize the draft learning outcomes relating to computer practices and perspectives as well as the cross-cutting core concepts.

The basic structures of the CS discipline are the focal point of the specification and, within that three strands, as depicted in Table 1.

Table 1. LCCS three strands.

<b>Title</b>	Strand 1: Practices and Principles	Strand 2: Core Concepts	Strand 3: Computer Science in Practice
<b>Description</b>	Overarching strand, the behaviours and ways of thinking necessary in CS	Represents CS content areas, developed theoretically and applied practically	Providing students with multiple opportunities to use their conceptual understanding of CS in practical applications
<b>Learning outcomes</b>	23 learning outcomes	22 learning outcomes	14 learning outcomes
<b>Strands</b>	Computational thinking, computers and society, design and development	Abstraction, Algorithms, Computer Systems, Data, Evaluation/Testing	Four ALTs: Interactive information systems, Analytics, Modelling and simulation, and Embedded systems

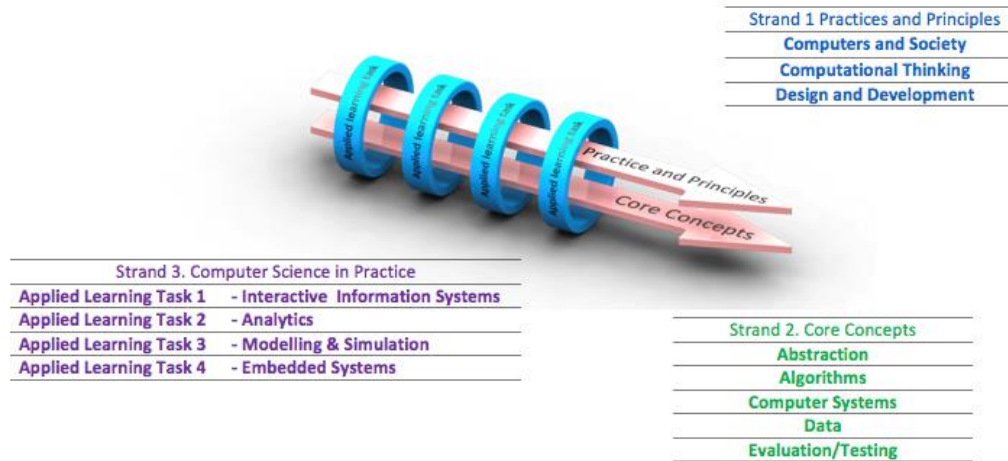


Figure 2. Computer Science Specification

### 1.2.1 LCCS curriculum development and design

Interestingly, and novel to CS curriculum development, the LCCS specification adopted a spiral curriculum approach, in which students' understanding of basic concepts and their interrelationships is intended to be reinforced by revisiting them in different contexts with ever-increasing sophistication. A spiral curriculum is not typical in the Irish education system, where “preparation for high-stakes tests often overemphasises rote memorisation and cramming by students and drill and practice as a teaching method.” (Conway and Sloan, 2005, p. 237). The spiral curriculum is novel within the Irish education system and specification design (see reference by Conway and Sloane, 2005). In the LCCS spiral curriculum, material is presented at appropriate times so as to be relevant to the particular projects in which the students will be engaging, and thus is learned within a context of application. For example, as seen in Figure 2, the skills and knowledge learned in Strands 1 and 2, are applied to collaborative applied learning tasks outlined in Strand 3. The Applied Learning Tasks (ALTs) in Strand 3 provide the practice context to the theory being introduced deepening the skills, concepts, attitudes and values for the CS student in the learning process through the practical projects. The 59 learning outcomes (NCCA 2017) evidence the coiled web of repeated engagement across the three strands. The spiral curriculum suits computer science teaching (Armoni, 2014; Jaime et al, 2016) and aligns with the work of Bruner (1996) who advocated that the fundamental ideas should be constantly revisited so that understanding deepens over time, as the three strands interwoven and studied concurrently. The learning outcomes for Applied Learning Task 1, for example, the interactive information system, has three learning outcomes where students should be able to understand and list user needs/requirements before defining a solution; create

a basic relational database to store and retrieve a variety of forms of data types; and use appropriate programming languages to develop an interactive website that can display information from a database that meets a set of users' needs. This ALT therefore contains a specific usage of abstraction, data and computer systems expanding on the learning outcome from Strand 2, along with 'Designing and Developing' from Strand 1 and consequently repeating CS concepts in various contexts to build a spiral curriculum.

### **1.3 CS pedagogical approaches**

CS pedagogical approaches are not uniform and the literature demonstrates some tension between exploratory (constructivist), making (constructionist) and direct teaching in CS education (Waite, 2017). The effectiveness of pedagogies relates to different phases of education, for different learners, catering for inclusion and diversity (Hansen, Hansen, et al., 2016; Webb et al., 2012). In a 2015 systematic literature review of computing education in K-12 schools, Garneli, Giannakos, and Chorianopoulos (2015) concluded that despite challenges, computing could be an effective learning experience but there was no one pedagogical solution for all classes. Falkner and Vivian (2015) identified that pedagogical support was generally missing from the resources reviewed, noting a focus on content knowledge. Reference is made to CS learners constructing knowledge as they explore and develop a personal understanding of newly introduced concepts or devices (Papert, 1980). Grover and colleagues (2015) suggest to foster deep learning, a combination of guided discovery and instruction, rather than pure discovery and 'tinkering', would be more successful. Despite a lack of consensus on exactly what computational thinking is and its merit (Barr & Stephenson, 2011; Grover & Pea, 2013; Tedre & Denning, 2016), proponents (Wing, 2011) advocate its importance and value to CS curricula and enactment. A lack of agreement on this, and the evolving nature of CS education, points to the need for developing communities of practice for teachers to meet their curriculum needs (both content and pedagogical) in teaching computer science (Yadav et al 2016).

With these pedagogical approaches in mind, and the emphasis the NCCA has placed on the teacher as a key agent of change alongside the language of learning throughout the LCCS specification, the concept of teacher agency is now explored in the curriculum enactment process from a figurational sociology perspective before moving onto the role of learner agency in this complex process.

### **1.4 Teacher agency (from a figurational viewpoint)**

In conceptualising ‘agency’, Biesta and Tedder’s (2007, p.137) definition is highlighted:

[T]his concept of agency highlights that actors always act by means of their environment rather than simply in their environment [so that] the achievement of agency will always result from the interplay of individual efforts, available resources and contextual and structural factors as they come together in particular and, in a sense, always unique situations.

Drawing on this conceptualisation, and adopting an ecological approach to teacher agency (Priestly, Biesta & Robinson, 2016), Priestley, Biesta and Robinson (2013) constructed a Figure which maps three dimensions from Emirbayer and Mische’s (1998) theory of agency to elements of teacher agency (please see Figure 3). As seen in Figure 3, the iterational dimension of agency, which encompasses an actor’s “past patterns of thought and action” (Emirbayer & Mische, 1998, p.971), highlights a teachers’ life and professional histories (for example, teacher education and teaching experience) (Priestley, Biesta, & Robinson, 2013). The projective dimension of agency, which expresses “the imaginative generation by actors of possible future trajectories of action” (Emirbayer & Mische, 1998, p. 971), alludes to the aspirations of the teacher’s work (short and long term) (Priestley, Biesta, & Robinson, 2013). The practical-evaluation dimension expresses “the capacity of actors to make practical and normative judgements among alternative possible trajectories of action, in response to the emerging demands, dilemmas and ambiguities of presently evolving situations” (Emirbayer & Mische, 1998, p. 971). Priestley, Biesta and Robinson (2013) identify three teacher agency elements to this dimension. Those being, cultural elements (ideas, values, beliefs, discourses and languages); structural aspects (relationships, roles, power, and trust); and material aspects (resources and the physical environment). Priestley and colleagues (2016, p.137) suggest the achievement of agency should be viewed as a “configuration of influences of the past [the iterational], orientations towards the future [the projective] and engagement with the present [the practical-evaluative]”.



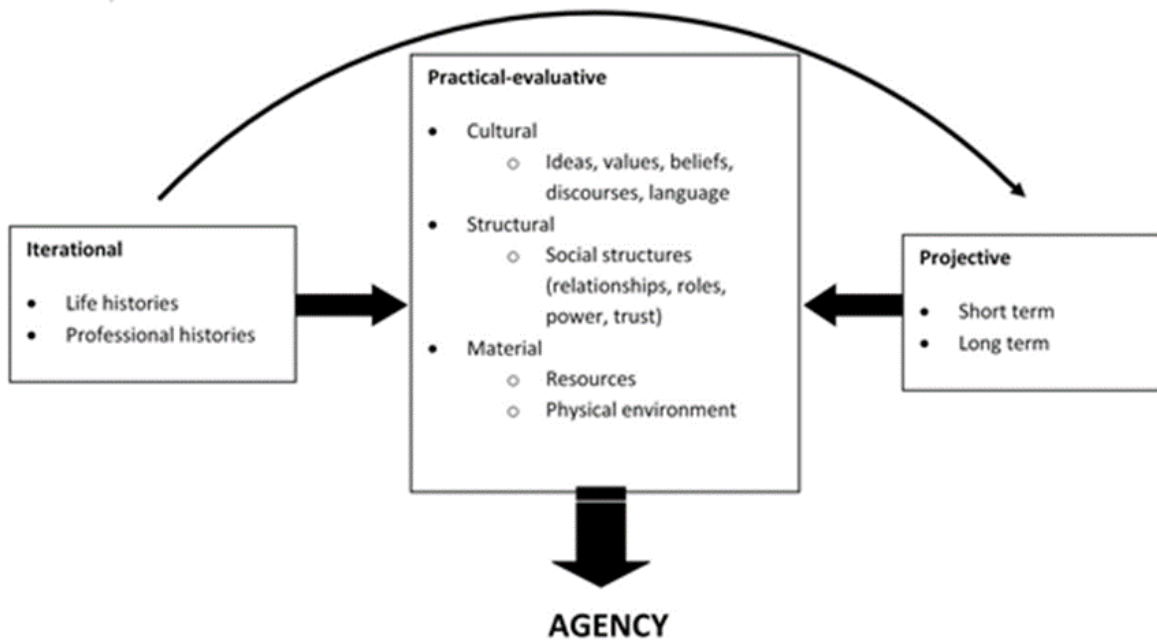


Figure 3: Understanding teacher agency (Priestley, Biesta, & Robinson, 2013; adapted from Emirbayer & Mische, 1998).

Author’s (2020) recent research, which explored teacher agency in enacting Irish physical education curriculum (Leaving Certificate Physical Education) in a period of curriculum change and reform, suggests an alternative viewpoint of teacher agency. That being, through a figurational sociology lens. The authors “propose that a teacher’s process of achieving agency is informed, enabled and constrained by their contextual and structural factors and, as we explicitly argue, their network of interdependent relationships, or their figuration” (Author, et al., 2020, p.14). Before delving into such viewpoint, it is necessary to briefly outline the key concepts of figurational sociology. Figurational sociology, which derives from Norbert Elias, contends that rather viewing action as separate to structure, they should be viewed in an interdependent relationship (van Krieken, 1998). This has significance for the process of achieving agency, in that, the teacher (who relays the action) operates within a web of interdependent relationships (structure) in the achieving of agency. As Elias (1978, p.72) puts it;

“one can understand many aspects of the behaviour or actions of individual people only if one sets out from the study of the pattern of their interdependence, the structure of their societies, in short from the figurations they form with each other”.

Three interlinked figurational concepts (figuration, habitus, and power) are focused on to further locate the teacher, and understand their actions, within their network of interdependent relationships.

A figuration, or “a structure of mutually orientated and dependent people” (Bloyce & Smith, 2010, p.4), consists of people in the plural in a complex web of interdependent relationships (Elias, 1978). It is argued that by exploring a person’s figuration is the best means to understanding their actions and relational influence of their social relationships on such actions (van Krieken, 1998). A figuration will be used in this study to locate the teachers and students in their respective (but interconnected) web of interdependent relationships to understand the ‘who’, ‘why’ and ‘how’ of their processes of achieving agency. Power is centralised within figurations and is conceptualised as something fluid which places people in powerful positions, rather than something one holds. As such, these unbalanced power-ratios enable or constrain relationships and actions constructed from such influential relationships (Keay, 2009). In this study, power will highlight the unbalanced power ratios between teacher and student, and will shed light on that enabling and / or constraining power differential in achieving agency. Habitus represents people’s constructed personality structure which becomes ‘second nature’ to the person (Mennell & Goudsblom, 1998) and actions engender from such dispositions. Habitus will help explain the teachers’ and students’ actions in their processes of achieving agency.

Author and colleagues (2020, p.13) mapped such figurational concepts onto Priestley and colleague’s (2016) model of teacher agency “to view their model through a different lens to gain a deeper understanding of the complexity in how a teacher achieves agency, and what (and who) influences this process”. The authors constructed Figure 4 which represents this figurational viewpoint of teacher agency (please see Author et al. (2020) for further details on such Figure and mapping process). In brief, each hexagon represents groups of people (which could be further down to multiple, interconnected hexagons). In Figure 4, some hexagons are labelled to given examples of these groups of people that are relevant to the study. The hexagons are connected through interdependent relationships and some relationships are stronger than others (represented by the shade of the multi-directional arrow). Habitus (iterational dimension) is constructed from the figuration which is represented by the direction of the curly bracket, i.e., the open end facing away from the figure to represent how habitus is constructed through and from the figuration. (Un)planned actions (projective dimension) are outcomes of the figuration which is represented by the direction of the curly bracket, i.e., the

open end facing away from the figure to represent how actions are outcomes of a figuration. The practical-evaluative dimension is encompassed in the concept of a figuration capturing the complexity of interdependent relationships. Author and colleagues (2020) work highlighted the use of this figure in understanding teachers' agentic actions. For example, a teachers' chosen pedagogical approach (an agentic decision) is not solely their decision but influenced by their habitus (iterational) and informed by their future goals/actions (projective). The teachers' chosen pedagogical approach (an agentic decision) is enacted in the present (practical evaluative) but is influenced, enabled and / or constrained by strong face-to-face interdependent relationships but (e.g., PDST, students, other teachers) but also non-face-to-face relationships (e.g., NCCA and Department of Education and Skills). This figuration viewpoint helps visualise the complexity of the concept of teacher agency and the influential, interdependent relationships which enable and / or constrain the achievement of agency.

While acknowledging the teacher has multiple interdependent relationships with multiple people and groups of people, as stated, some relationships are stronger than others. We turn our attention to one of the stronger sets of interdependent relationships, the students (whilst acknowledging the multiple, interlinked, interdependent relationships existing within one figuration). The focus here is explore the concept of learner agency and how this form of agency is influenced by various aspects of the educational context (Manyukhina & Wyse, 2019), or the figuration in which it operates in.

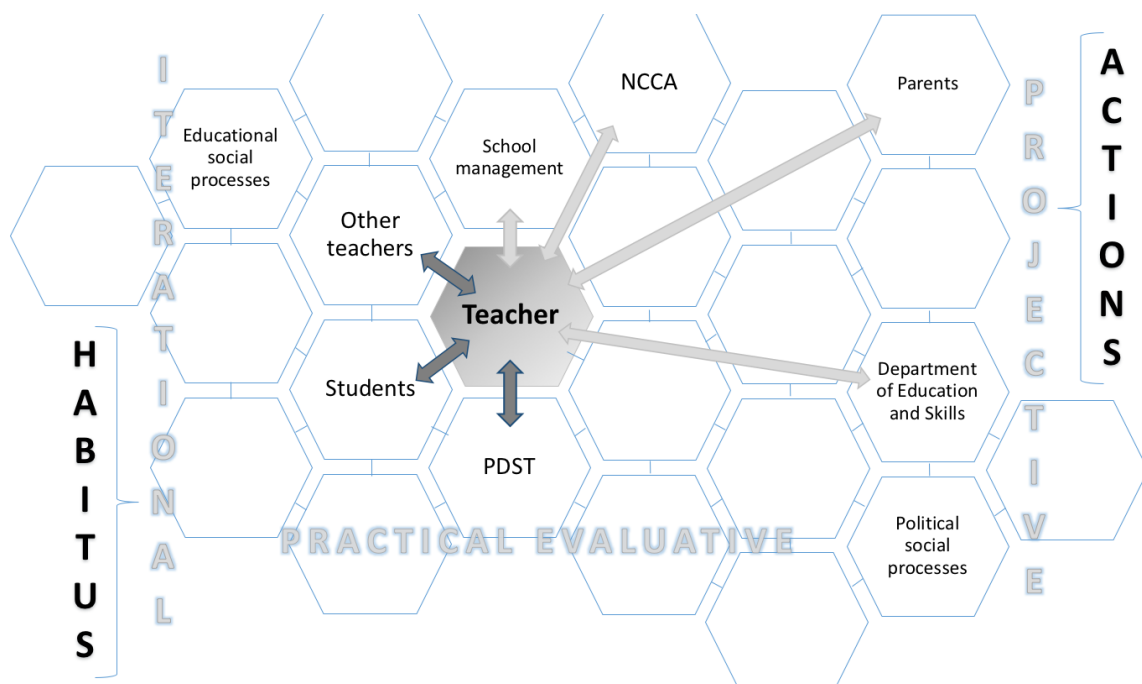


Figure 4: A figurational viewpoint of teacher agency; extracted from Author and colleagues (2020)

### **1.5 Learner agency**

While there appears to a growing body of research on teacher agency, the same cannot be said for learner agency which has been “neither satisfyingly theoretically nuanced nor sufficiently empirically informed” (Manyukhina & Wyse, 2019, p.224). Drawing on critical realism, Manyukhina and Wyse (2019, p.224) discuss learner agency “as a multi-dimensional, dynamic, and contextualised entity” and, in their research, explore the relationship between curriculum content and learner agency. Manyukhina and Wyse (2019, p.229) conceptualise learner agency in two dimensions:

- [1] learners’ personal sense of agency, i.e. a belief in their ability to make a difference to their learning within given settings, and 2) learners’ agentic behaviour - the point at which students actually exercise their agency by playing an active role in directing the learning process, e.g. making decisions, assuming control, taking an action or refraining from one.

Mercer (2012, p.41), whose research explored learner agency through complexity theory, suggests how learner agency needs to be viewed “as being situated contextually, interpersonally, temporally and intrapersonally”. With regards to being situated contextually, in a similar approach of adopting an ecological approach to teacher agency (Priestly, Biesta & Robinson, 2016), the social contexts, and the interdependent relationships in which the students operate within, shape the learning environment, the learning experience, and the enactment of the learning outcomes (Manyukhina & Wyse, 2019). Learner agency being situated contextually is reflected in the concept of ‘affordances’ (Mercer, 2012) which we allude to later in the paper. The next ‘level’ of this conceptualisation is interpersonal. Learner agency is situated interpersonally through numerous interactional partners (for example, teachers and peers) who influence, enable and constrain a student’s learner agency (Manyukhina & Wyse, 2019; Mercer, 2012). The intrapersonal dimension is also recognised in this multi-level, multi-dimensional situated context which can include views and beliefs, motivations, and past experiences. Learner agency as temporally situated recognises how agentic action or behaviour engenders from past experiences but also in relation to informing future goals and expectations

(Manyukhina & Wyse, 2019). In this temporal dimension, learner agency “is continually fluctuating, changing and adapting to variations...[and] changes in contextual parameters” (Mercer, 2012, p.50).

Within this multi-level, multi-dimensional situated context, Mercer (2011) suggests the key to effective self-directed learning is the ability to exercise learner agency. Rather than viewing learner agency as a capacity in which a student can act on, we conceptualise learner agency as something in which a student aims to achieve (consciously or subconsciously); a student operating in the process of *achieving* learner agency (Author et al., 2020). To enable students to operate in such a process, opportunities need to be provided to the students whereby they can have responsibility over the learning process (Manyukhina & Wyse, 2019). Students must be able to access and recognise these opportunities, or as Mercer (2011) terms them, ‘affordances’; as Manyukhina and Wyse (2019, p.227) point out, “contextual opportunities become affordances only when students recognise the potential for learning inherent in them”. While Manyukhina and Wyse (2019) explored the relationship between learner agency and curriculum, we aim to understand the relationship between teacher agency and learner agency from a figurational viewpoint in the enactment of LCCS. As such, we recap on our research questions;

- How does teacher agency and learner agency play a role in the enactment of a new school subject (LCCS)?;
- To what extent does figurational sociology help explain the relational manner between teacher agency and learner agency?

## **1.6 Methods and methodology**

A case study approach (Bryman, 2012) was adopted to allow for a deeper exploration into a particular context and the complex processes (i.e., teaching and learning) operating within that context. Ethical approval was gained by the second author’s institute.

### ***1.6.1 Sampling, participants and data gathering***

Participants were sampled through a purposively and convenience sampling approach (Bryman, 2012) at the Computers in Education Society of Ireland (CESI) annual conference. An invitation was circulated to the 40 CS teachers by the organisers of the conference and four teachers volunteered to participate in the focus groups on the day of the conference. Of the four volunteers, their education pathway to teach Computer Science was varied with half

having worked in the technology industry prior to returning to qualify as a teacher. The geographical location of the schools were in the East of the country with the school type varied including voluntary secondary schools and the vocational Education Training Boards represented also. The gender of the teacher participants was mixed. Another teacher got in contact with the authors and volunteered to be involved in the study. This teacher and their students also acted as the participants for this study. While we recognise the limitations of a volunteer sample, we felt this was an opportunity which could shed light on the realities of teaching and learning LCCS (and the role of teacher and learner agency within that). The school which was used in the pedagogical case study was a mixed gender, urban school which was enacting LCCS for the first time as a phase one school. For the student focus groups, the teacher asked her class who would like to be involved in the study and the participating student volunteers were then chosen by the teacher. Nine students were involved in the focus groups and split into two separate focus groups (five in one and four in the other focus group). The teacher asked her class who would like to be involved in the focus groups and as such, the students were volunteered. As such, this data represents their views and not the views of all LCCS students. Similarly, given the teachers are volunteers, we are aware that these may be proactive teachers and do not represent the practices of all LCCS teachers. While this may be considered a limitation of the study, this is the reality of qualitative research. As with all qualitative research, this data cannot be generalised, but this was not the intent of paper. Rather, this paper was to explore the realities of enactment (through the concept of teacher agency and learner agency). Given a small number of schools were involved in phase one of LCCS implementation (40 nationally), participating teachers may be traceable and as such, limited information on these teachers are given.

The two teacher focus groups consisted of four teachers (two in each focus group). The purpose of these focus groups was to gain a broad understanding of the teachers' realities of enactment of LCCS. The interview schedule was presented in six sections: 'background' (for example, talk me through your professional background and education?); 'preparedness to teach' (for example, to what extent did you feel prepared to deliver the LCCS curriculum?); 'planning and teaching' (for example, can you talk me through your pedagogical approaches in the classroom, and examples?); 'context' (for example, what support structures / facilitators are in place to support you in the delivery of LCCS?); 'reflecting on teaching LCCS' (for example, what were the main challenges / main positives throughout the year?); and 'closing

questions' (for example, what would be your overall advice for a teacher taking LCCS next year be?). One interview lasted 46 minutes and the other 67 minutes.

From these interviews, much of the data gathered focused on the teaching and learning of the subject. As such, a pedagogical focus of the enactment of LCCS needed to be further explored from a teacher and student perspective, and where (and how) teacher agency played a role in this pedagogical process. A teacher and her students were purposively sampled for this purpose, i.e., to gain a deeper understanding of the context in which a LCCS teacher teaches in and the students learn in. For this teacher, the interview schedule was similar to the focus group interview schedule but a further section was added in which focused on 'curriculum' (for example, can you reflect on the content of LCCS and the manner in which it is structured through learning outcomes?), 'pedagogy' (for example, can you reflect on the pedagogical approaches you used in your classroom and examples?), and 'assessment' (for example, can you reflect on how you assessment your students both formatively and summatively?). The intent here was to gather rich quality data on the teachers pedagogical approaches used in enacting the LCCS curriculum. The interview last 35 minutes.

For the student focus groups, the interview schedule had three sections. Those being: 'expectations' (for example, what was your main reasons for choosing to study LCCS?); 'opportunities' which was further broken into 'content' (for example, what do you think of the course content?), 'assessment' (for example, how have you been assessed so far?), and pedagogy (for example, talk me through how your teacher teachers you); 'challenges' which was also broken into 'content' (for example, what aspects of the content did you find challenging?), 'assessment' (for example, can you provide examples of how the assessment has been challenging?), and 'pedagogy' (for example, are you happy with how your teacher is teaching the subject?). The purpose of these focus groups was to understand how the students learned through their teachers pedagogical approaches and how they operated in the learning environment. Further to this, we aimed to understand the relationship between learner agency and teacher agency in the learning and teaching of LCCS. The interviews lasted 40 minutes. The teacher and student qualitative data was used for the pedagogical case study. These interviews took place in the teacher's school.

Given the second author's background is in computer science teacher education, and is therefore emotionally involved in the subject area, the second author (whose background is in physical education teacher education) conducted the interviews and data analysis (the second author was consulted throughout all processes). This enabled a level of

involvement/detachment throughout the data collection and analysis process (Perry, Thurston, & Green, 2004).

### **1.6.2 Data analysis**

The data was analysed through three phases of coding (Charmaz, 2014). Through initial coding, descriptive codes were recorded which reflected the complex, processual nature of the data from multiple voices (which was particularly important for the focus group interviews). The second phase of coding (focused coding) involved a constant comparative approach (Weed, 2009) in selecting and refining codes. Through this process, categories and sub-categories were constructed. Up to this phase of coding, the coding was conducted inductively. The next phase of coding, theoretical coding, took a deductive approach as the sensitising concepts (teacher agency, learner agency and figural concepts) were used to make sense of the constructed categories and sub-categories (Charmaz, 2014). Table 2 provides examples of the coding process in the three phases for one aspect of one constructed category (i.e., supportive (online) relationships). The double ended arrows represent the processual, non-linear nature of the phases; these phases are no separate entities (Thornberg & Charmaz, 2012). The first author conducted the data analysis but after each stage of coding (initial, focused, and theoretical), both authors regularly met to discuss, agree, disagree, and come to consensus around the theoretically informed constructed categories and sub-categories. The following section is presented by sharing the findings under each category followed by a discussion.

<b><u>Three phase coding process (Charmaz, 2014)</u></b>	
<b>Initial coding (examples)</b>	
<ul style="list-style-type: none"> <li>- Sharing of resources between teachers</li> <li>- Shared mock paper between teachers</li> <li>- Sharing resources encourages creativity and co-creation</li> <li>- A lot of help from the teachers</li> <li>- Can ask other teachers for help</li> <li>- Collaborative work between the teachers</li> <li>- Other LCCS teachers help when you are in ‘panic mode’</li> <li>- Emails between teachers</li> </ul>	<ul style="list-style-type: none"> <li>- Main support is the online support</li> <li>- Slack (online community) is very successful</li> <li>- Slack is more successful than face-to-face professional development</li> <li>- Online communication system allows for supportive dialogue</li> <li>- People post questions if they have difficulty with something</li> <li>- Working in one big online community</li> </ul>



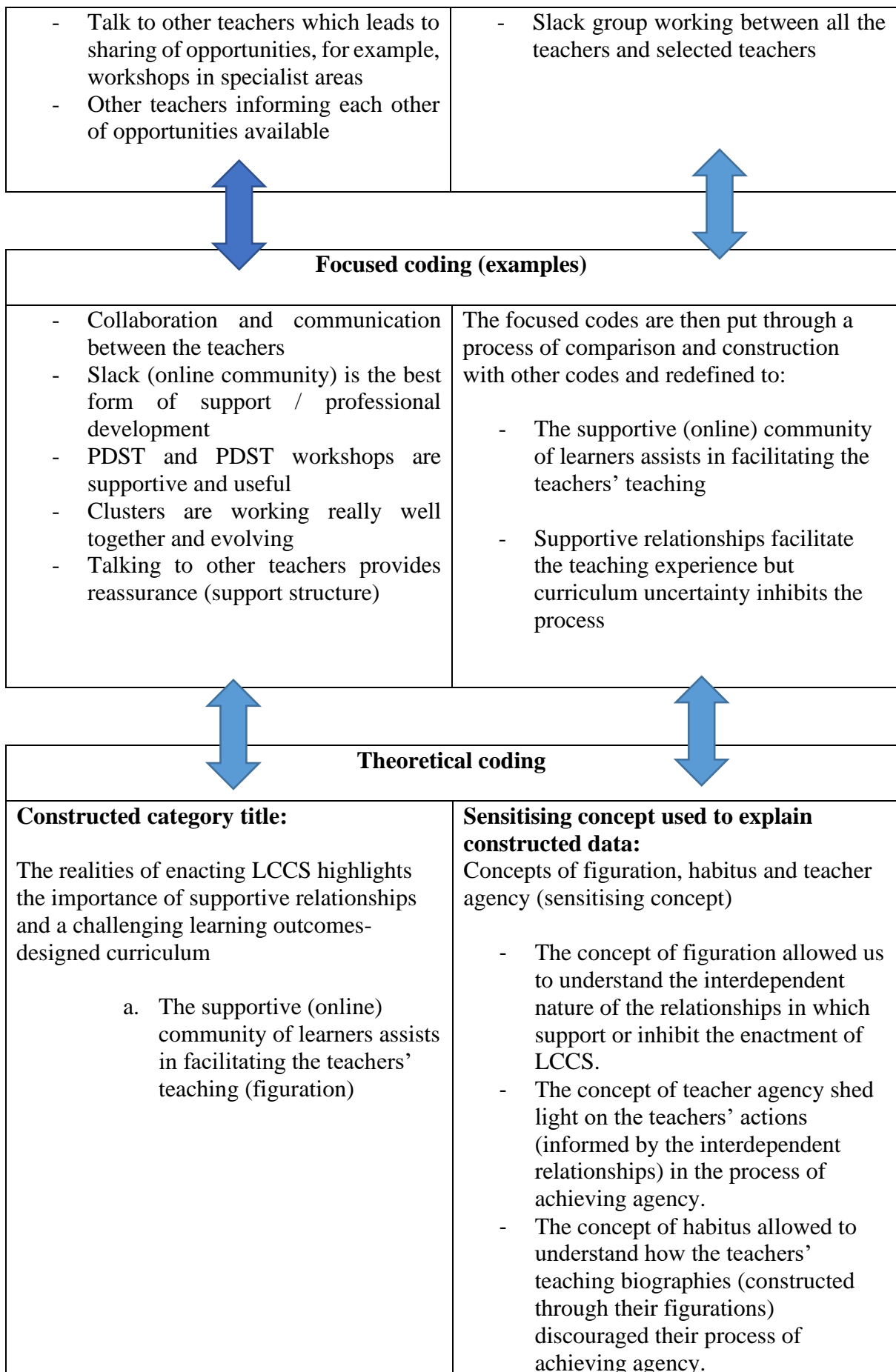


Table 2: Examples of codes during the three phased coding process for one aspect of one constructed category (Charmaz, 2014)

## **1.7 Findings and Discussion**

### ***1.7.1 The realities of enacting LCCS highlights the importance of supportive relationships and a challenging learning outcomes-designed curriculum***

When the teachers discussed what facilitated and supported their teaching, the notion of ‘relationships’ was centralised in their answers. Relationships with the students, other teachers, an online support community, and the Professional Development Service for Teachers (PDST) were alluded to. While face-to-face interaction with other LCCS teachers at professional development days was encouraged, the SLACK (an online community for LCCS teachers set up by the PDST) proved to be invaluable for support, guidance and reassurance:

[for] the training days [there would be] smaller clusters where it’s the teachers meeting with each other...That was kind of PDST encouraging us to talk to each other, but I think the SLACK thing is probably the more successful part in that... People post queries there, so if you have a difficulty with something, you post it there (Jade, focus group 1 (FG1))

School management were also recognised being “very supportive in giving you what you need [for example, equipment, classroom space etc.]” (Emmet, FG2). On the other hand, two main threads throughout the focus group interviews inhibited their teaching process. Those being, competency in computer science and curriculum uncertainty.

The teachers had differing and varying levels of confidence and experience with the multiple platforms and programming languages directed by the LCCS specification (particularly in regard to programming languages JavaScript and Python). The teachers discussed how it is difficult for them to have a satisfactory level of knowledge in the various platforms and programming languages:

When you’re trying to bring in UX design, HTML, JavaScript, CSS, all that into one single project and whatever their project is about as well... (Kate FG1)

I've got a good bit of experience in Python...when I look at a student's program, it doesn't take me two seconds in to go, "you're missing a comma there, you're missing that, you haven't closed the bracket there". You just see it straight away, but [if I do the] same thing with JavaScript, I can look and go, "I don't know what's wrong" because I just don't have the skill (Jade FG1)

While there were a few encouraging comments regarding the learning outcomes-designed curriculum ("I suppose you can design your own learning experiences and you can probably interpret them your own way as well" (Emmet, FG2)), the majority of the conversation critiqued this curriculum design approach and the lack of guidance it provides the teachers emphasising an issue of depth in the learning outcomes (in terms of the depth of knowledge needed to be taught in a specific learning outcome), as one teacher comments:

I think the learning outcomes are clear enough [but] I'd like another column that says 'to this level'...You never know have you covered it enough. (Evan FG2)

While there appears to a lack of pedagogical direction for the teachers, the teachers are engaging with student-centred pedagogies in their teaching, a type of pedagogy which is not common at Leaving Certificate level for both teacher and students. One teacher highlights his fondness for these approaches but giving responsibility to the students over their own learning is something new for Leaving Certificate students:

I love it [the move to a more student-directed pedagogy]. I think it's great...[but you do have students] waiting for full instruction... [particularly with the project] they might say, "Well, what do I do next?" And [I am] going, "That's up to you. You can do this or you can do this or you can do this." Some students want to be told...You're saying, "It's your project. You're the one who has to talk about it and demonstrate it and show your understanding of it, so you have to make the decisions." That is difficult for some students. (Emmet FG2)

This same teacher comments on how the use of student-centred approaches are new to Leaving Certificate students and their effectiveness differs depending on the students he is teaching:

[Speaking of student-centred pedagogical approaches] you get them in groups. You might look at one theoretical aspects and even say for obstruction and decomposition... then each group...focus[es] on obstruction [and decomposition]... then they all come back to each other and present. That kind of thing has worked well for us... I've seen

them walking around the class helping each other, and it's brilliant, whereas when you go back and you're starting again with the fifth years and you see them and they're a bit "we don't know each other and we don't know the other people. We don't like her"...Then you're saying, "Okay, well there you go. You're all together and you're working on this," and they don't like it. (Emmet, FG2)

The teachers used a lot of group work approaches to encourage peer teaching and peer learning but some teachers were wary of the level of learning occurring within the group. One teacher acknowledges this and advocates for a blended of teacher-directed and student-centred approaches:

If you have a group of four, two students will get a lot from it. But, the other two students are sitting on the side-line and they actually have learnt nothing in three months, effectively. How do you combat that?...There's a real danger with throwing out the traditional approach completely and I think there has to be a blended approach of the two (Kate, FG1)

Interestingly, the teachers believed they needed to know the content knowledge before they can delve into the pedagogical knowledge; separating the content and pedagogical knowledge. One teacher alludes to this in giving advice to the next cohort of teachers:

Get up to speed on those [different platforms and computing language], because you kind of already want to have those as a toolkit before you even start to talk them at the pedagogy. What's happening is you're trying to learn and teach at the same time and there's a conflict there because you're trying to manage your own learning as well as their learning at the same time and trying to marry the two. It's very difficult... 'd love to be more involved with the pedagogy, but I don't even know it [content knowledge] myself in the first place. That's kind of real frustrating. (Jade, FG1)

As Priestley and colleagues (2016) acknowledge, the achievement of agency (or rather, the process of achieving agency (Author et al., 2020)) occurs in the present (the practical-evaluative dimension), is influenced by the past (the iterational dimension) and is directed towards the future (the projective dimension). The interplay between each dimension is evident in the teachers responses to the realities of enacting the LCCS curriculum. Viewing this

interplay through a figurational lens further sheds light on the ‘who’ and the ‘why’ of involvement in the process of achieving agency. While there are multiple interdependent relationships existing in each of the individual teachers’ figurations, all the teachers highlighted a number of positive influential interdependent relationships in their quest for agency in terms of support and reassurance (i.e., other teachers) and the provision of materials and resources (i.e., school management and PDST). Interestingly, their interdependent relationship with other teachers was not solely face-to-face but online. While Green (2002) identifies non-face-to-face relationships in figurations (for example, in the context of this paper, the NCCA act as a non-face-to-face relationship to these teachers), based on these findings, we add another set of relationships to the concept of a figuration, online interdependent ‘screen-to-screen’ relationships. These provided crucial in the enactment of LCCS and the supportive element of such interdependent relationships assisted in the process of achieving agency.

A factor which discouraged the teachers’ process of achieving agency seemed to be their own teaching biographies, or their habitus (the iterational dimension) (Elias, 1978). The curriculum requires the use of multiple platforms and programming languages, some of which the teachers did not have experience in or educated about. The subject criteria for CS teacher registration with the Teaching Council of Ireland when the subject commenced in schools was not finalised and consequently there are no CS teachers registered by the Teaching Council. The majority of the phase one CS teaching cohort were qualified to teach another subject and some CS teachers had computing experience but had never taught to Senior Cycle level. A result of having such varied backgrounds, research has shown that beginning CS teachers inevitably struggle to meet pedagogical demands in the classroom, as they lack adequate computer science content and pedagogical knowledge to effectively teach computer science (Yadav et al., 2016). This was evident in Jade’s comment regarding the difficulty of learning (content) and teaching (pedagogy) at the same time.

Although somewhat critical of the learning outcomes designed curriculum, in one sense, the curriculum enabled the process of achieving agency as the flexibility of the learning outcomes encouraged pedagogical possibilities at Leaving Certificate level (i.e., student-centred pedagogies). The unbalanced power-ratios (Maher, 2010) in the teachers’ figurations are evident in their agentic teaching decisions of teaching through student-centred pedagogies. While the teachers made these agentic teaching decisions in the present (the practical-evaluative dimension) to develop their students’ skills and give them responsibility over the learning to assist their learning for their future assessment components (the projective

dimension), the success of these approaches was inhibited by their students unfamiliarity and therefore, a somewhat resistance to such approaches. In the teaching moment outlined by Emmet, the power balances shifted from the teacher to the students, putting the students in a powerful position and therefore resisting the agentic teaching decision and subsequently, impeding Emmet's process of achieving agency.

Similar to Author and colleague's (2020) findings, the fluctuation of the process of achieving agency is noticeable in the teachers' response. By this we mean, the 'achievement' of agency is not a straightforward identifiable moment. For example, with particular reference to Emmet's comment, while the enactment of student-centred approaches may be perceived as an 'achievement' of agency, the teachers did not perceive this as an achievement due to their critiques of the learning outcomes designed-curriculum and their students reaction to such student-centred pedagogies. Although the move to student-centred pedagogies seems to be an agentic decision, this does not necessarily represent an 'achievement' but rather, an encouraging move in the process of 'achieving' agency. This encouraging move was facilitated by the curriculum and their teaching biographies, or habitus, but their interdependent relationship with their students in the present (the practical-evaluative dimension) inhibited the move given the students' own learning biographies and their own figurations. As such, the process of achieving agency, the interplay of the three dimensions (Priestley et al., 2016), can be situated in the operations and mechanics of the teachers' figurations. The fluctuation of the process of achieving of agency is a result of multiple interacting and interconnected elements occurring in the classroom. We are suggesting a strong interdependent relationship between teacher and student heavily influences this fluctuation (amongst other interconnecting elements). This was noticeable in Emmet's comment on how the effectiveness of his pedagogical approaches are dependent on the students he is teaching and their interdependent relationships with each other. In this example, Emmet's agentic decision is considered an enabling and constraining move in his process of achieving agency. We explore this notion, and the fluctuation of the process of achieving agency, deeper by 'zooming in' on one teacher and their students.

### ***1.7.2 Pedagogical case study of one teacher teaching, and their students learning, LCCS***

Grace (pseudonym) is a LCCS teacher who, and her students, acted as part of the pedagogical case study. While Grace discussed and detailed many aspects of her pedagogical approaches

in the enactment of LCCS, including the facilitators (e.g., other teachers on SLACK) and barriers (e.g., the issue of depth of treatment in ‘vague and broad’ learning outcomes), we focus on three aspects of her teaching and learning to explore the relationship between teacher agency and learner agency.

#### *1.7.2.1 Project-based learning: ALTs*

It is understood that the PDST are encouraging LCCS teachers to blend the theory and the practical CS activity in an integrative manner through project-based learning (ALTs). Grace was not keen on this approach, believing an ‘old-school’ approach to teaching theory continues to have benefit:

So, the PDST wants us to teach the theory through those lenses. I don't agree with that because in the exam the questions are quite concrete in terms of what they want and teaching it through the lens of the ALTs, I feel is a bad idea. Because if a student is in the middle of an ALT and you bring their attention to a theory part of the ALT, I feel that they don't take it in because they're so focused on their projects that... So, I don't agree with that. It's old-school, old-school, but I think PowerPoint, videos on YouTube, that sort of thing, their own research on activities, can be beneficial... PowerPoint and activity then, to reinforce the learning (Grace)

Although Grace seems to separate theoretical knowledge and practical knowledge (‘PowerPoint then activity’), her students comment how learning theory through applied practical experiences, for example coding, allows them to develop a better understanding of the theoretical knowledge while enhancing their applied skillset:

[With regards coding; We did] many projects that can help us to learn and understand. And then, towards the end, we'd have a bigger one that would help put it all together and it was so we'd remember it better and we could use it for future projects (Student FG2)

The students also commented how this blended, integrative approach (of theory and practice) informed their summative written assessment component:

The coding can often somewhat tie into the written test as well because a focus on some of the theory and then you actually put that theory in use as opposed to just knowing theory and then not really doing anything with it. (Student FG1)

It is interesting to note how the students preferred to learn in one way (an integrated approach through the applied practical experiences) and the teacher taught in another way (separating theoretical and practical knowledge). This misalignment became noticeable in the relationship between teacher agency and learner agency as we will discuss later on.

#### *1.7.2.2 A teacher facilitator role allowed for an appreciated student-centred pedagogy*

Grace discussed how she adopted a facilitator role in her classes which she commented was a “welcome relief” (Grace) from the typical pedagogy used at Leaving Certificate level (e.g., rote learning); Grace considered herself “the facilitator of learning” (Grace). This facilitator role allowed Grace to enact student-centred pedagogies such as active learning, group work, components of problem-based learning etc. For the students, these pedagogies translated into an engaging class and the opposite of rote learning:

It was more engaging than some of the other courses [school subjects]...there was more of a focus on kind of a different way of teaching as opposed to just... learn this, learn this, learn this (Student FG1)

The enacted student-centred pedagogies allowed for peer teaching, peer learning, and self-/peer- assessment. Grace provides an example which embeds all three of these opportunities as a result of student-centred pedagogies:

[with regards to assessing the students formatively in coding; I hand out worksheets and say] ‘Do this question. Any problems, put up the hand’...[the students start] talking to one another. They're pointing at each other's screens. They're moving each other's mice and stuff like that. They're talking to each other. That's formative assessment. That's peer assessment right there. And self-assessment then through commenting and describing the code and stuff like that. That's self-assessment. And then when they've done the question, then they put up the hand. I can look at their code, they can run it, they can show me it works and answer the question. And I can give them instant teacher feedback then, at that moment...And the students can change that immediately and they learn. (Grace)

The students compared LCCS to Mathematics in terms of promoting problem solving skills and critical thinking skills but in LCCS, it was done “in a more positive way” (Student FG1).



When asked to expand on this, it seems the opportunity to interact with peers and engage in self-assessment represented the ‘more positive way’:

Because it definitely helps towards that sense of comradery and the solutions for problems are more ingrained in your mind when you can solve it with someone else.  
(Student FG2)

You'd be more hands on yourself and sorting like your own problems with the coding things...it'd be almost like kind of grading your own teaching as well because you'd be...learning as you go along and assessing your own problems with the coding part  
(Student FG1)

### *1.7.2.3 Building a sense of a learning community by giving the students more responsibility in their learning*

The students very much respected their teacher and the types of pedagogy she enacted in teaching LCCS. The students consistently commented on how they appreciated the level of trust their teacher had for them in allowing peer teaching and peer learning occur. The students took ownership over their learning journey as the teacher took a step back, as one student commented: “the kind of more self-learning...was kind of eye-opening” (Student FG1). The following conversation (from Student FG 2, pseudonyms given) between the students captures this and provides an insight into the learning community their teacher put in place:

Fiona: [there’s] always [some other student] willing to go over and help, and that's what I love that [our teacher] lets us talk with [them], talk with each other and help each other out.

Brian: There's a lot of freedom to just get up and ask someone. You don't have to sit there and wait and put your hand up and stuff. There is... We're all kind of-

Alan: Not restrictive.

Brian: Yeah. I think there's a definite sense of trust that we're all mature enough to stay on task and keep to the point and talk to each other and stuff.

Kyle: A lot of time [in other Leaving Certificate subjects] we're just sitting in our seats and they're just reading stuff to us and we're just expected to just take it all in. But with

this, when we are doing our codes, if we can get up and help each other and just go into the PowerPoints and stuff... [Our teacher] just teaches a bit different than just telling us all to sit down and just listen.

Brian: We're always going to be on topic...but we're free to get up and ask each other questions and stuff. So, I think that's kind of really one of the big things that sets it apart from the other subjects. (FG2)

The lack of pedagogical direction in the specification (and the learning outcomes design nature of the specification) provides the LCCS teachers with challenges and opportunities, and a level of freedom to teach the content in their own way. This level of freedom allows Grace to diverge from the PDST recommended approach to teaching the theory through project-based learning (ALTs) to a more 'old-school' approach through PowerPoint. The relationship between teacher agency and learner agency is evident in this agentic decision. While Grace separates the theoretical knowledge and practical knowledge in this approach (an agentic decision influenced by an interplay of the three dimensions of teacher agency (Priestley et al., 2016)), the students commented how they learned better when the theoretical knowledge was integrated with the practical knowledge. Therefore, their learner agency, their ability to direct their own learning and their preferred means to learn, is limited due to their teacher's agentic decision. An encouraging move in Grace's process of achieving teacher agency (separating theoretical and practical knowledge) resulted in a discouraging move in the students' process of achieving learner agency (the potential of learning theory through applied practical experiences). We acknowledge that students are only aware to the pedagogical approaches that they are exposed to by their teacher but their comments here highlight the potential of certain pedagogical approaches and the enabling influence such pedagogical approaches can have on their process of achieving learner agency.

While this can be seen as a discouraging influence, encouraging influences are also evident in this pedagogical case study. The construction of the curriculum allowed Grace to adopt a facilitator role in her approach to teaching and therefore enabled her to enact student-centred pedagogies in her classroom. This can be seen as an encouraging shift in her process of achieving agency and a result of the resources (curriculum) and relationships (students) available to her in the present (practical-evaluative), and her teaching biography, or habitus (iterational) (Priestley et al., 2016). This student-centred approach allowed for a more engaging

experience for the students and shifted the responsibility of the learning to the students, providing them ownership over their own learning (Manyukhina & Wyse, 2019); providing the students with ‘affordances’ (Mercer, 2011). Grace encouraged self-assessment, peer-teaching, and peer-learning, and provided affordances for these to occur which the students appreciated as they commented how they learned better by solving problems with others and ‘grading your own teaching’. It is clear from the students’ commentary that the students recognised the potential for learning in the affordances provided by the teacher (Manyukhina & Wyse, 2019). This example highlights the positive influence Grace’s agentic decision in her process of achieving teacher agency encourages the students’ process of achieving learner agency.

Grace seems to be building a learning community for her students whereby the students work together directing their own learning whilst being guided by the teacher. The constructed learning community encompasses and encourages the four situated elements outlined by Mercer (2012). For example, Grace’s use of student-centred pedagogies and related student choices (contextually situated) encourages peer interaction, peer learning, and peer teaching (interpersonally situated) whereby students are preparing for the LCCS assessment components (temporally situated). While they enjoy and are motivated by this approach, their other Leaving Certificate experiences (intrapersonally situated) can inhibit the learning communities potential in that, the students are not familiar with this type of teaching at Leaving Certificate level and are therefore, hesitant to completely engage in such an approach.

Viewing this from a figurational lens, we can gain a snapshot of how complex the classroom is as each student is a part their own figuration with multiple interdependent relationships existing (for example, other students, other teachers, school management etc), each with their own power-ratios and informed by their own habitus. While literature on learning communities with students is more common to higher education discourse (Roberston & Barber, 2017), post-primary teachers and post-primary curriculum makers can learn from this and capitalise on the uses of learning communities for encouraging learner agency. Building a learning community, facilitating a learning community and offering affordances (Mercer, 2011) can promote learner agency in a high-stakes environment and enable the process of achieving learner agency. As seen through these findings and discussion, there is an influential relationship (positive and negative, encouraging and discouraging) between teachers’ agentic decisions in their process of achieving teacher agency and the students process of achieving learner agency. The use of learning communities heightens this relationship and may be useful in providing a positive or encouraging shift in the process of achieving teacher and learner

agency. Before we move onto viewing this agentic relationship from a figurational viewpoint, we briefly discuss how the LCCS specification supports or constrains this agentic relationship.

The CS specification is a knowledge-centred curriculum characterised by a strong emphasis on disciplinary CS knowledge. In failing to acknowledge a connection between curriculum and pedagogy, a knowledge-centred curriculum may fail to pay heed to learners' agentic systems (Manyukhina and Wyse, 2019) and the failure to relate curriculum design to pedagogical practices can be considered a serious oversight (Rata, 2012). Though this was not necessarily the case in the design of the CS specification, there does appear to be a disconnect in the teachers' understanding of the curriculum, i.e., the spiral curriculum, (content) and their approach to teaching the subject (pedagogy). This is also evident in the students' perception of self-directed learning and the culture necessary in a CS classroom. This is an overarching difficulty for the CS teachers as the novel nature of the subject (i.e., the spiral curriculum design) is incomparable to other knowledge-centred subjects they teach and the students learn in; highlighting the influential role of teaching / learning biographies, or habitus, in the process of achieving teacher / learner agency.

What proves to be interesting is how the LCCS specification supports elements of Manyukhina and Wyse's (2019) multi-level situated context needed for the process of achieving learner agency. For example, according to the CS specification, the teacher is recognised as a facilitator for the students at the start of term, and the CS teachers and students become co-participants in the process of discovering, exploring, and creating CS knowledge. Further, the CS specification allows for some student perspective in the ALTs whereby the teacher can build on the learners' individual characteristics, such as their personal backgrounds, interests, goals, and priorities (Manyukhina & Wyse, 2019). As such, the learning experience, with personal relevance, will facilitate and enhance the learners' agentic systems (Manyukhina & Wyse, 2019). Finally, the CS specification aims to deliver a curriculum which does not necessarily follow a linear sequence of hierarchically predefined steps, but rather aims to ensure students are active participants in their learning. Curriculum and policy enactment research has highlighted 'policy slippage' (Penney & Evans, 2005) in enactment (from policy, the curriculum specification, to the teaching in the classroom) as teachers interpret, translate, and enact policy (curriculum) in many different ways (Ball, Maguire, Braun & Hoskins, 2011). Braun, Ball, Maguire, and Hoskins (2011) suggest that the context shapes policy enactment. With regards to this study, and specifically the relationships between teacher agency and

learner agency, we explore the ‘context’ from a figurational perspective in how it shapes the agentic relationship (as part of the policy enactment process).

### **1.8 A figurational viewpoint of the relationship between teacher agency and learner agency**

In analysing the students’ discussion and aligning their experiences of the process of achieving agency with Mercer’s (2012) four levels of the multi-level, multi-dimensional situated context, we gain a deeper understanding of the context which enables or constrains the process of achieving learner agency. Interestingly, these four levels can be aligned with three dimensions of teacher agency. By aligning such elements, we gain an appreciation of the complexity in the process of achieving teacher and learner agency but also, as teacher educators, gain an idea of where best to invest our energies in supporting this process. We extend Author and colleagues’ (2020) work and explicitly argue that this multi-level, multi-dimension conceptualisation of teacher agency (Priestley et al., 2013) and learner agency (Mercer, 2012) can be viewed as a congregation of elements at play through interdependent relationships (both past and present, recognised and unrecognised (Green, 2002)) in a teacher’s figuration and a student’s figuration. We are suggesting that these figurations exist within each other and the interdependent relationship between teacher and student is a ‘strong’ relationship (amongst numerous other interdependent relationships) which greatly influences, directs, enables, and constrains the process of achieving teacher agency and learner agency. To explicit this argument, we extend Author and colleagues’ (2020) constructed Figure 5 to include the multi-level, multi-dimensional conceptualisation of learner agency and place it within the complexity of a figuration (please see Figure 5).

As seen in Figure 5, the iterational dimension aligns with the intrapersonal dimension as both highlight past experiences. From a figurational point of view, this can be captured through the concept of habitus. This was seen in the complimentary and conflicting teaching and learning habits, or habitus, of the teacher and students in this study, for example, the integration of theoretical and practical knowledge into the same learning experience. As planned future goals (goals, expectations, and aspirations of the teacher and learners) which are captured in the temporal dimension of learner agency (Manyukhina & Wyse, 2019) and the projective dimension of teacher agency (Priestley, et al., 2013), these are aligned in Figure 5 given both dimensions focus on the ‘future’. The figurational lens highlights how these original

plans can result in unintended consequences and actions. For example, in this study, Grace planned her teaching in a way which she thought would benefit her students (the separating of theoretical and practical knowledge) but due to the complex, strong interdependent relationship in her figuration (students), this resulted in the constraining of the process of achieving learner agency as this was not the manner in which her students wanted to or preferred to learn. Mercer's (2012) conceptualisation of the interpersonal dimension is positioned in relation to the practical-evaluative dimension (and the figuration in general) given its focus on relationships. For example, Grace's agentic decision of enacting student-centred pedagogies (an enabling move in her process of achieving teacher agency) provided the students with 'affordances' (Mercer, 2011) and therefore, enabled the students' process of achieving learner agency; highlighting the encouraging (and discouraging) influences of the interdependent relationships between the teacher's figuration and the student's figuration. Learner agency being contextually situated (Mercer, 2012) is placed at the end of Figure 5 as this is captured in the operations and mechanics of a figuration and overlaps in each of the three dimensions. The students' interdependent relationships are emphasised by the numerous multi-directional arrows emerging from the students hexagon and other groups of people in the plural (Elias, 1978). The stronger relationships, in the context of achieving agency, are emphasised by the shade of the arrows. Figure 5 visualises the complexity of a teacher's and student's figuration, and the complimentary, encouraging, and discouraging potential influences on the process of achieving teacher and learner agency. It also emphasises how the teacher and students are only one element in their complex individual (but interdependent) process of achieving teacher and learner agency. We explicitly argue that the responsibility should not be placed on these people (teacher and student) in achieving agency (as a product) but it is a combination of the teacher and the students *and* the other interdependent relationships within their figurations, alongside contextual factors, and educational social processes, which determine the fluctuation of the process of *achieving* teacher and learner agency.

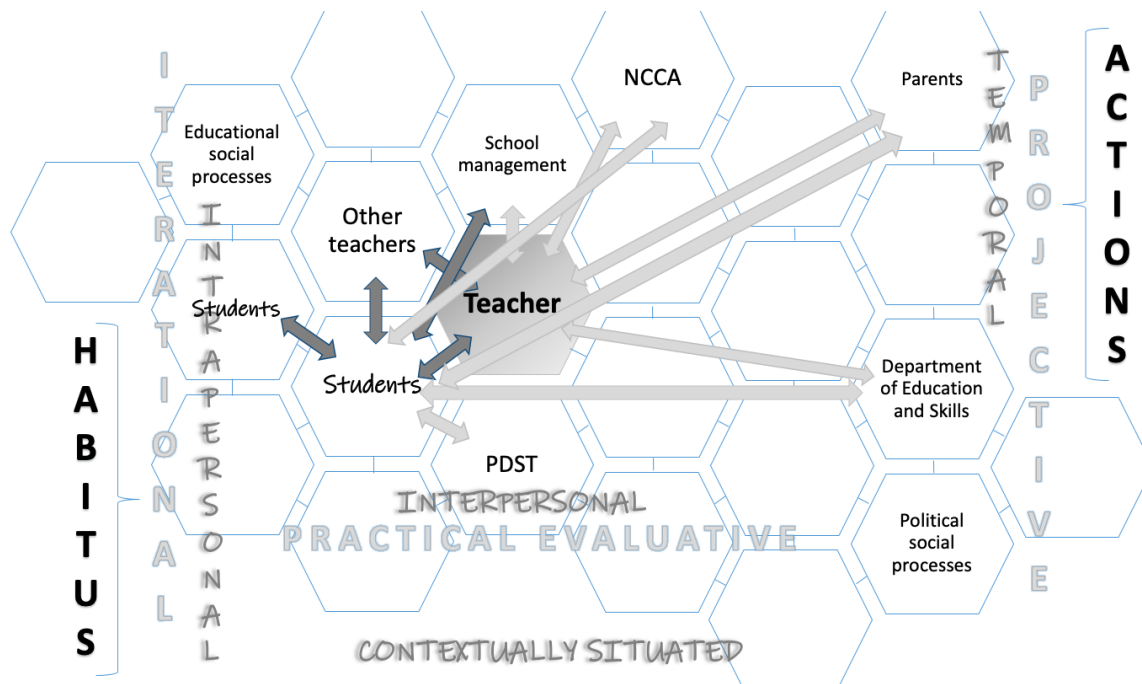


Figure 5: A figurational viewpoint of teacher agency and learner agency (adapted from Author and colleagues (2020).)

## 1.9 Conclusion and considerations for teacher education

There is a shortage of teachers who are able to teach beyond basic ICT or computer applications (Schulte, et al, 2012) and calls have been made for faculty in education and computer science to work collaboratively, using their complementary expertise (Yadav, Hong & Stephenson 2016). In examining the realities of teaching a new school subject (LCCS) in a high-stakes environment from the teacher and student perspective, we are provided with considerable insights to incorporate in initial teacher education.

The role of technology in supporting CS teachers was very evident, along with the value of the CS teacher community of practice providing technical and moral support. As stated in the LCCS specification “Leaving Certificate Computer Science is underpinned by collaboration and working with others.” (NCCA 2017, p 14). Initial teacher education CS methodology courses has an opportunity to showcase a spiral curriculum and integrate learning to include that of learning communities, student teaching and challenge student teachers to consider multiple perspectives in order to advance collaborative problem solving. For example teacher education CS methodology courses must discuss and debate effective and creative strategies of teaching and assessing the ALTs (Strand 3) with peers; reflect upon CS

background knowledge and experiences (Computers and Society, Strand 1) as well as their values, beliefs and conceptions about teaching, learning and assessing computer science; design and incorporate teaching and learning strategies to assess and support literacy and numeracy issues in CS and other national policies; create learning portfolios documenting across-the-curriculum integration of CS core concepts such as abstraction, data, algorithms, testing (Strand 2) to reinforce instructional alignment; appreciate the central role in creating the learning experience for their learners and champion CS education.

Learner agency plays a role in the enactment of LCCS where it is evident that the students enjoy the responsibility of directing their own learning (with peer / teacher support). We therefore need to ensure our pre-service teachers have confidence in the ‘facilitator role’ and have a broad pedagogical repertoire consisting of student-centred approaches. While we acknowledge teacher education cannot provide the ‘right’ route for the achievement of teacher agency, teacher education can educate pre-service teachers on pedagogical approaches which can enable the process of achieving teacher agency (and therefore, the process of achieving learner agency for their students). The move to online and remote teaching during the Covid-19 pandemic now may present opportunities for initial CS teacher education providing authentic learning experiences enhancing both technological and intercultural collaboration competencies - where the goal is to qualify CS teachers who can learn systematically, can facilitate learning, use methods and develop knowledge necessary to improve teaching and learning for future generations.

## **1.10 References**

- Armoni, M. (2014). Spiral thinking: K--12 computer science education as part of holistic computing education. *ACM Inroads*, 5(2), 31-33.
- Ball, S. J., Maguire, M., Braun, A., & Hoskins, K. (2011). Policy actors: doing policy work in schools. *Discourse: Studies in the Cultural Politics of Education*, 32(4), 625-639.
- Barr, V., & Stephenson, C. (2011). Bringing computational thinking to K-12: what is involved and what is the role of the computer science education community? *ACM Inroads*, 2(1), 48-54.



- Braun, A., Ball, S. J., Maguire, M., & Hoskins, K. (2011). Taking context seriously: towards explaining policy enactments in the secondary school. *Discourse: Studies in Cultural Politics of Education*, 32(4), 585-596.
- Biesta, G. (2009). Good education in an age of measurement: On the need to reconnect with the question of purpose in education. *Educational Assessment, Evaluation and Accountability*, 21(1), 33-46.
- Biesta, G. J., & Tedder, M. (2007). Agency and learning in the lifecourse: towards an ecological perspective. *Studies in the Education of Adults*, 39, 132-149.
- Bloom, B. S. (1956). *Taxonomy of educational objectives*: New York: McKay.
- Bryman, A. (2012). *Social research methods*. New York: Oxford University.
- Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education*. Routledge.
- Conway, P. F., & Sloane, F. C. (2005). International trends in post-primary mathematics education: Perspectives on learning, teaching and assessment.
- DES (2016). *STEM Education in the Irish school system*. Department of Education and Skills. <https://www.education.ie/en/Publications/Education-Reports/STEM-Education-in-the-Irish-School-System.pdf>
- Elias, N. (1978). *What is sociology?* New York: Comumbia University.
- Emirbayer, M., & Mische, A. (1998). What is agency? *The American Journal of Sociology*, 103, 962-1023.
- Falkner, K., & Vivian, R. (2015). A review of computer science resources for learning and teaching with K12 computing curricula: An Australian case study. *Computer Science Education*, 25(4), 390–429.
- Garneli, V., Giannakos, M. N., & Choriantopoulos, K. (2015). Computing education in K-12 schools: A review of the literature. Global Engineering Education Conference (EDUCON), 2015 IEEE (pp. 543–551). IEEE.
- Goode, J., Margolis, J., & Chapman, G. (2014, March). Curriculum is not enough: The educational theory and research foundation of the exploring computer science professional development model. In *Proceedings of the 45th ACM technical symposium on Computer Science education* (pp. 493-498). <https://doi.org/10.1145/2538862.2538948>

- Grover, S., & Pea, R. (2013b). Computational Thinking in K–12 A Review of the State of the Field. *Educational Researcher*, 42(1), 38–43. doi:10.3102/0013189X12463051
- Hansen, A., Hansen, E., Dwyer, H., Harlow, D., & Franklin, D. (2016). Differentiating for Diversity: Using Universal Design for Learning in Elementary Computer Science Education. *Proceedings of the 47th ACM Technical Symposium on Computing Science Education* (pp. 376–381). ACM.
- Haberman, B. (2006). Pedagogical patterns: A means for communication within the CS teaching community of practice. *Computer Science Education*, 16(2), 87-103. <https://doi.org/10.1080/08993400600786994>
- Jaime, A., Blanco, J. M., Domínguez, C., Sánchez, A., Heras, J., & Usandizaga, I. (2016). Spiral and project-based learning with peer assessment in a computer science project management course. *Journal of Science Education and Technology*, 25(3), 439-449.
- Keay, J. (2009). Being influenced or being an influence: New teachers' induction experiences. *European Physical Education Review*, 15(2), 225- 247.
- Lam, B. H., & Tsui, K. T. (2013). Examining the alignment of subject learning outcomes and course curricula through curriculum mapping. *Australian Journal of Teacher Education*, 38(12), 6.
- LERO (2020). Exploring teachers' professional development to support the roll-out of Computer Science in Irish second-level schools. <https://lero.ie/sites/default/files/LCCS%20PD%20Final%20Report%20August%202020.pdf>
- Lysaght, Z., Scully, D., Murchan, D., O'Leary, M., & Shiel, G. (2019). *Aligning Assessment, Learning and Teaching in Curricular Reform and Implementation*. Retrieved from Dublin: <https://ncca.ie/media/3925/aligning-assessment-learning-and-teaching-in-curricular-reform-and-implementation.pdf>
- Manyukhina, Y., & Wyse, D. (2019). Learner agency and the curriculum: a critical realist perspective. *The Curriculum Journal*, 30(3), 223-243.
- Menekse, M. (2015). Computer science teacher professional development in the United States: a review of studies published between 2004 and 2014. *Computer Science Education*, 25(4), 325-350. <https://doi.org/10.1080/08993408.2015.1111645>

- Mercer, S. (2012). The complexity of learner agency. *Apples - Journal of Applied Language Studies*, 6(2), 41-59.
- NCCA. (2009). *Towards Learning: An overview of Senior Cycle education*. Dublin: NCCA.
- NCCA. (2018). *Senior Cycle Review: What is the purpose of senior cycle education in Ireland?* Dublin: NCCA
- NCCA. (2017). *Leaving Certificate Computer Science specification*. National Council for Curriculum and Assessment. <https://curriculumonline.ie/Senior-cycle/Senior-Cycle-Subjects/Computer-Science/>
- Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. Basic Books, Inc.
- Priestley, M., Biesta, G., & Robinson, S. (2016). Teacher agency: What is it and why does it matter? In J. Evers, & R. Kneyber, *Flip the system: Changing education from the ground up* (pp. 134-148). Abingdon, OX: Routledge.
- Priestley, M., Biesta, G., & Robinson, S. (2013). Teachers as agents of change: Teacher agency and emerging models of curriculum. In M. Priestley, & G. Biesta, *Reinventing the curriculum: New trends in curriculum policy and practice* (pp. 187-206). London: Bloomsbury Academic.
- PDST (2017), Leaving Certificate Computer Science CPD Framework, Professional Development Service for Teachers. <https://www.scoilnet.ie/uploads/resources/26525/26261.pdf>
- Roberston, L., & Barber, W. (2017). New directions in assessment and evaluation: Authentic assessment in fully online learning communities. *Education Research*, 11(3), 249-262.
- Ryoo, J. J., Margolis, J., Estrada, C., Tanksley, T. C., Guest-Johnson, D., & Mendoza, S. (2019, February). Student Voices: Equity, Identity, and Agency in CS Classrooms. In *2019 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)* (pp. 1-2). IEEE. doi: 10.1109/RESPECT46404.2019.8985947.
- Authors (2020)
- Schulte, C., Hornung, M., Sentance, S., Dagiene, V., Jevsikova, T., Thota, N., ... & Peters, A. K. (2012, November). Computer science at school/CS teacher education: Koli working-

- group report on CS at school. In *Proceedings of the 12th Koli Calling International Conference on Computing Education Research* (pp. 29-38).
- Tedre, M., & Denning, P. J. (2016). The long quest for computational thinking. *Proceedings of the 16th Koli Calling Conference on Computing Education Research* (pp. 24–27).
- van Krieken, R. (1998). *Norbert Elias*. London, United Kingdom: Routledge.
- Waite, J. (2017). Pedagogy in teaching computer science in schools: A literature review. *London: Royal Society*.
- Webb, D. C., Repenning, A., & Koh, K. H. (2012). Toward an emergent theory of broadening participation in computer science education. *Proceedings of the 43rd ACM technical symposium on Computer Science Education* (pp. 173–178). ACM
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.
- Wing, J. M. (2011). Computational thinking. *VL/HCC* (p. 3).
- Yadav, A., Gretter, S., Hambruch, S., & Sands, P. (2016) Expanding computer science education in schools: understanding teacher experiences and challenges, *Computer Science Education*, 26:4, 235-254, DOI: 10.1080/08993408.2016.1257418
- Yadav, A., Hong, H., & Stephenson, C. (2016). Computational thinking for all: pedagogical approaches to embedding 21st century problem solving in K-12 classrooms. *Techtrends*, 60(6), 565-568.