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Teaching for Tomorrow

21st Century Learning in Action

TfT Survey Report on 21st Century Practices in EU Classrooms

TfT has carried out a survey on the integration of 21st Century (21C) teaching and learning practices across European partner countries. The successful integration of 21C practices in different European countries is subject to various factors that may impede or foster its broad uptake. It faces various challenges at systemic and classroom levels the various European countries. Therefore, it is necessary to collect empirical knowledge about the present situation in order to tailor the promotion of 21C practices to the specific national needs.

The results of the survey are published in this report.

www.tft-project.eu

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Executive Summary

Background

The perceived importance of a '21st Century' (21C) approach to teaching and learning is well documented (Conneely, Lawlor, & Tangney, 2015; Dede, 2010a; Voogt & Pelgrum, 2005; Voogt & Roblin, 2012). Reasons cited include a shift in the global economic focus away from traditional goods and services, towards a knowledge-based economy (Claxton, 2013). Dede (2010a) observes that in the modern workforce, 21C skills involving higher-order thinking and communication are increasingly required, not only in the labour force, but also for citizenship and self-actualisation in modern society (Dede, 2010b; Voogt & Pelgrum, 2005). However, the integration of 21st Century (21C) teaching and learning practices into the classrooms is complex; it involves changes at system and classroom levels, and the provision of adequate resources.

The Erasmus+ project, Teaching for Tomorrow (TfT), is investigating the topic of the integration of 21C practices in the classroom. TfT is a partnership between institutions in four countries (Ireland, Sweden, Estonia and Germany) that is working to develop a model of 21C teaching and learning across subject areas. Initially, a questionnaire was designed to identify the barriers to, and facilitating factors for, 21C practices in the classroom as perceived by participating teachers. In TfT, readiness for integration is taken as involving *confidence* in using and encouraging, and *frequency* of using, these practices. The analysis presented here reports on the responses from the 145 teachers who volunteered to take part in this portion of the project.

Aims and Purpose of the Present Study

This report examines these teachers' perceptions of the predictors for, and barriers to, the integration of 21C pedagogic practices in European post-primary schools, addressing the question: *For these respondents, what are the predictors for and barriers to confidence and frequency of usage of 21C practices in the classroom?*

Methods and Research Design

Data are drawn from teachers' responses to a questionnaire from an Erasmus+ project, Teaching for Tomorrow (TfT), addressing readiness for the integration of 21C practices, and involving teachers in Ireland, Sweden, Estonia and Germany. Use was made of Wilcoxin Signed Ranks tests, one-way ANOVAs and multiple regressions to analyse quantitative data, and a directed content analysis approach was taken to interpret qualitative data.

Main Findings

Findings indicate that system restrictions and resources are major barriers, and that classroom management and teacher beliefs impact on confidence with and frequency of use of 21C practices in the classroom.

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1. Main Report

1.1 Theoretical Framework: 21st Century Teaching and Learning

There is no unique, universally agreed definition of 21C skills or of the types of pedagogic approaches required to achieve them. However, in their comparative analysis of international frameworks for 21C competences, Voogt and Roblin (2012) note a common recognition of the importance of skills relating to communication and collaboration, problem-solving, and creativity, as well as technological fluency. Many of these are classified as higher-order thinking and learning skills, and are seen as being transversal (not subject-specific) and multi-dimensional, impacting on attitudes and knowledge (Dede, 2010a; Voogt & Roblin, 2012). Existing frameworks for 21C skills include those provided by the Organisation for Economic Cooperation and Development (OECD),[1] Erasmus+,[2] the Partnership for 21st Century Skills,[3] and Ravitz, Hixson, English, and Mergendoller (2012).

In this research, the concept of 21C skills aligns with the work of Ravitz et al. (2012), which emphasises a project-based, collaborative, and student-led pedagogic approach in line with the model being developed by TfT.[4] It presents a concise and comprehensive definition of 21C skills, and also provides a validated questionnaire measuring confidence with, and frequency of implementation of, eight specific skills identified as intrinsic to 21C teaching and learning:

1. **Critical thinking** (CT) – analysis of complex problems, investigation of questions for which there are no clear-cut answers, evaluation of different points of view or sources of information, and use of appropriate evidence to draw conclusions;
2. **Collaboration** (CO) – ability to work together to solve problems or answer questions, working effectively and respectfully in teams to accomplish a common goal, and assuming shared responsibility for the completion of a task;
3. **Communication** (CM) – ability to organise thoughts, data and findings and to share these effectively through a variety of media, including oral presentations and written reports;
4. **Creativity & Innovation** (CR) – generation of solutions to complex problems or tasks based on analysis and synthesis of available information, and combination or presentation of the results in new and original ways;
5. **Self-direction** (S) – taking responsibility, both for one's own learning through the identification of topics to pursue and processes for learning, and for reviewing one's own work and responding to feedback;
6. **Using technology** (T) – management of learning and creation of products using appropriate information and communication technologies;
7. **Global Connections** (G) – understanding global and geo-political issues including the history, politics, geography, culture, and literature from other countries;

[1] www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=EDU/WKP(2009)20&doclanguage=en

[2] www.erasmusplus.org.uk/file/272/download

[3] www.p21.org/storage/documents/docs/P21_Framework_Definitions_New_Logo_2015.pdf

[4] For more information, see www.bridge21.ie and tft-project.eu

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8. **Local Connections** (L) – application of what has been learned, within local contexts and communities.

Also relevant regarding teachers' opinions and current levels of usage of, and perceived barriers to the implementation of, 21C learning practices is the Promoting Inquiry in Mathematics and Science Education across Europe (PRIMAS) report (Euler & Maaß, 2011). In the report, four factors were identified for *opinions* and *usage*:

1. **Teachers' orientation** (ORI), relating to beliefs about 21C learning in the classroom;
2. **Knowledge dependent** (KND), reflecting a belief that the success of 21C learning is dependent on the prior levels of student knowledge;
3. **Motivation** (MOT), referring to the belief that 21C learning is good for motivating students; and
4. **Routine usage** (ROU), relating to regular usage of 21C learning in the classroom.

The PRIMAS report also identified three factors relating to *barriers* to the integration of 21C learning practices:

1. **System restriction** (SYS), for example curriculum and assessment, time constraints, and class sizes;
2. **Inadequate resources** (RES), including continuing professional development (CPD) and communities of practice as well as physical resources; and
3. **Classroom management** (CLA), referring to discipline and management of groups, assessment in the class, and confidence.

1.2 Survey

1.2.1 Questionnaire Design

The questionnaire used to gather data for the TfT project was developed by the Irish partners in Trinity College Dublin, and was available online from November 2015 to January 2016. It involved 4 main sections, as follows:

1. *Background information*, including number of years teaching and subjects taught;
2. *Teachers' beliefs about the nature of teaching and learning*, with items adapted from the OECD Teaching and Learning International Survey (OECD, 2010) to address two constructs:
   a. **Direct Transmission Beliefs** (DTB), relating to traditional educational practices (such as teacher demonstrations, encouraging a quiet workspace, and delivery of facts);
   b. **Constructivist Beliefs** (CB), reflecting a more creative and inquiry-based approach to teaching, in which the students' own construction of knowledge is facilitated;
3. *Opinions of 21C teaching and learning*, with items adapted from the PRIMAS report:
   a. For opinions and current usage: **Teachers' orientation** (ORI), **Knowledge dependent** (KND), **Motivation** (MOT) and **Routine usage** (ROU);
   b. For barriers: **System restriction** (SYS), **Inadequate resources** (RES) and **Classroom management** (CLA);

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4. *Confidence with and frequency of integration of 21C skills in practice*, with items adapted from the 8 subscales identified by Ravitz et al. (2012):
    a. For Confidence: **Critical thinking** (CT), **Collaboration** (CO), **Communication** (CM), **Creativity & Innovation** (CR), and **Self-direction** (S),
    b. For Frequency: **Collaboration** (CO), **Communication** (CM), **Creativity & Innovation** (CR), **Using technology** (T), **Global Connections** (G), and **Local Connections** (L).

Apart from the background section, the items used a 5-point Likert-type scoring system to generate quantitative data: 1 - 'strongly disagree' to 5 - 'strongly agree', for beliefs and opinions (20 items), 1 - 'not at all confident' to 5 - 'very confident' for confidence (30 items), and 1 - 'never' to 5 - 'every day' for frequency of usage (32 items). In addition to the Likert-type items, there was one open-ended item in the Barriers section, "Please comment on the main difficulties that hinder the implementation of 21C learning in your lessons."

1.2.2 Participants

TfT Project administrators in each of the four countries were responsible for recruiting participants. Colleagues were contacted in person, by email or through relevant groups, and were requested to complete the online questionnaire. All of the responses were provided voluntarily.

Of the 145 teachers who responded to the questionnaire, 50 were Estonian, 38 Irish, 33 Swedish, and 24 German; their teaching experience ranged from less than 1 year to 42 years. In terms of the breakdown between male and female respondents (Figure 1), the results clearly represent a majority of female teachers, this is particularly marked in the Estonian cohort. Out of the responding teachers, Ireland has the closest match between male and female practitioners.

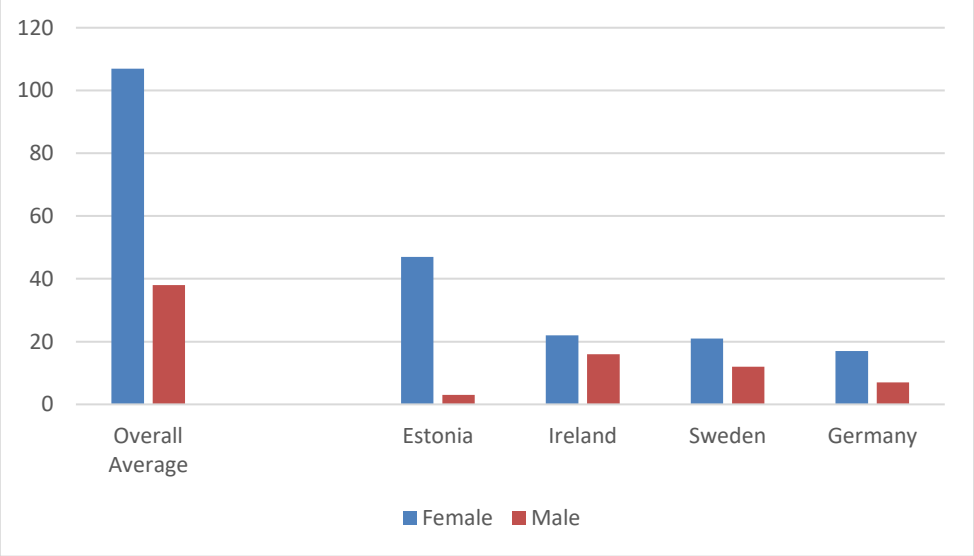

Figure 1: Gender Breakdown

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1.2.3 Data Analysis

The findings have been analysed and reported on using three lenses: a general overview, an analysis of the relationships between the categories (predictors and barriers), and qualitative results.

For the quantitative data, multiple regressions were performed to identify whether the categories of *beliefs, opinions and usage*, and *barriers* had a significant bearing on teachers' *confidence* with, and *frequency* of, integration of 21C learning practices in the mathematics classroom. Use was made of Wilcoxin signed rank tests and one-way ANOVAs to compare the mean ratings across the four participating countries on each of the factors, with Bonferroni tests identifying where any significant differences lay.

For the qualitative data, directed content analysis (DCA) was employed (Elo & Kyngäs, 2008; Krippendorff, 2004). DCA is a structured approach that allows for pre-existing theory to guide the analysis. The process begins with a theory or relevant research, leading to identification of key concepts and variables that are used as coding categories (Moretti et al., 2011). These categories direct the analysis of the data, with any passages that do not fit with the pre-determined codes assigned a new one (Hsieh & Shannon, 2005).

1.3 Description of Current Practice

1.3.1 Overview

This section presents findings for the whole group of 145 teachers and also for the four national subgroups. Statistically significant differences are noted where relevant.

1. *Teachers' beliefs about the nature of teaching and learning*: the mean values of constructivist beliefs are higher overall, and in all participating countries, than direct transmission beliefs. Statistically significant differences were recorded overall ($p < 0.05$) (Figure 2).

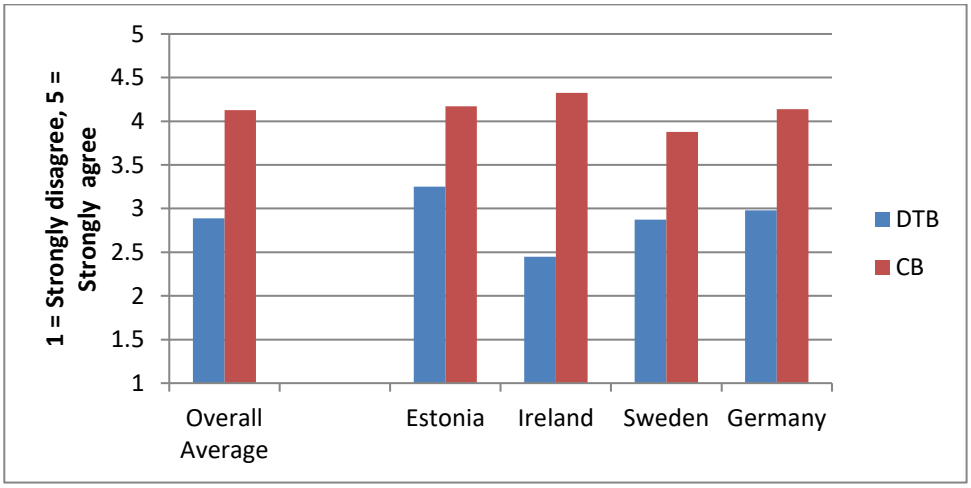

Figure 2: Teachers' Beliefs

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2. *Opinions of 21C teaching and learning*: for *barriers*, overall means for system and resource barriers were close to 'undecided'. Classroom management barriers were reported as having significantly less impact than system restrictions and inadequate resources ($p<0.05$) (Figure 3).

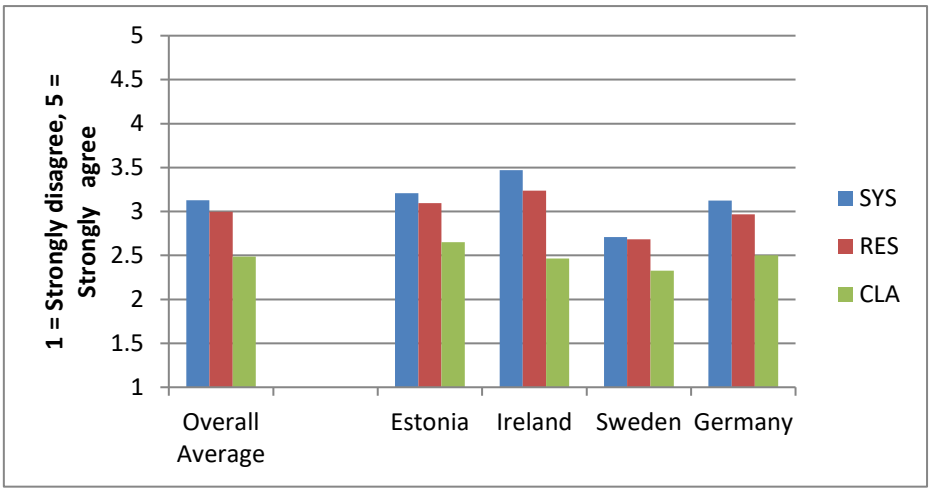

Figure 3: Classroom barriers

The results for *opinions* indicate that respondents on average recognise the importance of 21C learning and would welcome an increase in the levels of support for such practices (orientation – ORI). They also tend to agree that 21C practices have the potential to increase student levels of motivation (MOT). However, levels of routine usage of 21C practices did not fully reflect this (ROU) (Figure 4).

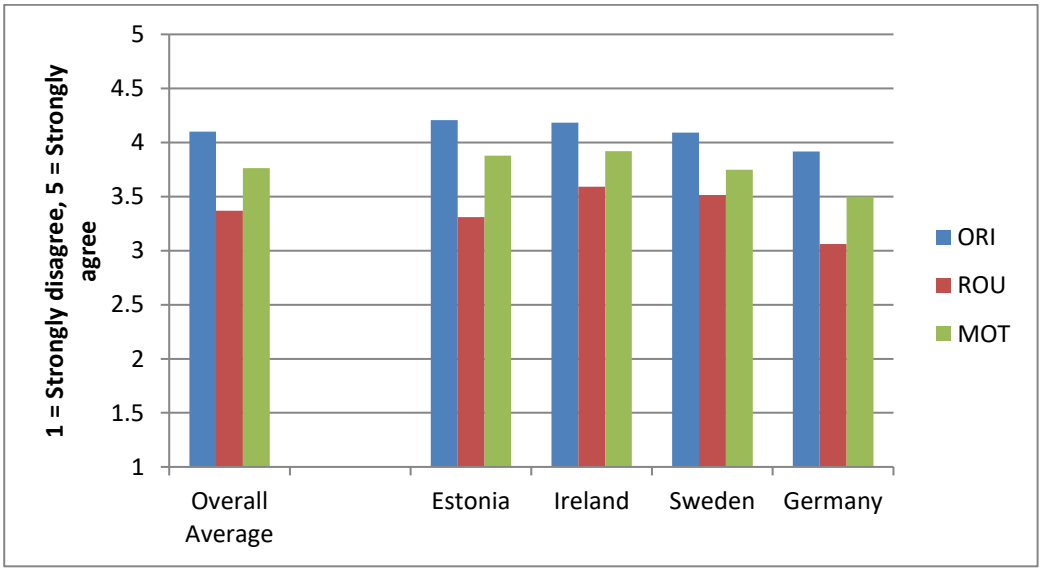

Figure 4: Opinions

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3. *Measures of 21st Century Teaching Practices*: For *confidence*, overall mean scores for each of the constructs were positive (between 3.5 and 4.5). However, one-way ANOVA tests revealed significant country differences in the Critical Thinking (CT) Collaboration (CO), Communication (CM), Creativity and Innovation (CR), and Self-direction (S) scales; In particular, Bonferroni tests showed that the German teachers had significantly lower levels of confidence than the Estonian, Irish and Swedish teachers in encouraging Critical Thinking, Collaboartion and Self-direction practices, and than the Irish and Swedish respondents in Communication and Creativity and Innovation practices (Figure 5).

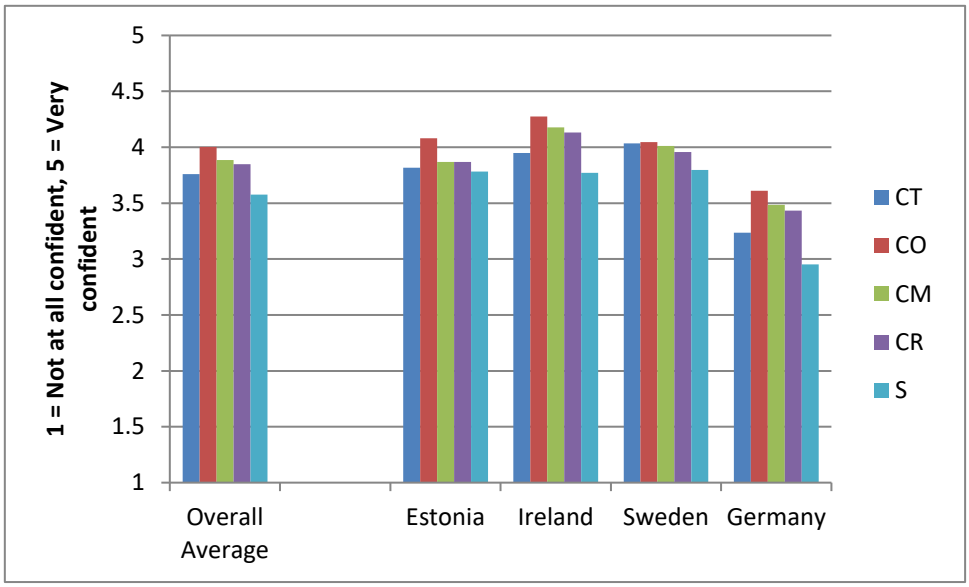

Figure 5: Levels of Confidence

With regard to *frequency of use*, Local (L) and Global (G) Connections appear to be the least frequently used 21C learning practices across all the countries (overall means close to 2.5, i.e. '2/3 times per year'), with mean scores for Communication, Collaboration, Creativity, and Technology usage reported as 'every month'. The analysis identified significant differences in the Technology (T) and Collaboration (CO) scales: Bonferroni tests indicated that the teachers from Estonia report significantly lower levels of Technology usage than those from Ireland (Figure 6), and teachers from Sweden report significantly lower levels of collaboration than those from Germany.

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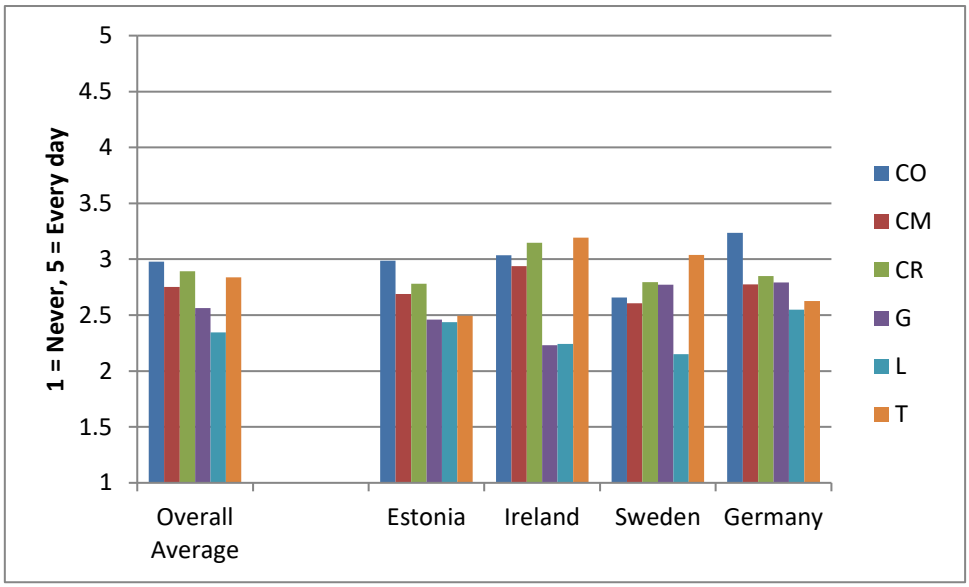

Figure 6: Frequency of usage

1.3.2 Predictors for, and Barriers to, 21C Practices

This section seeks to identify whether the categories of *beliefs*, *opinions and usage*, and *barriers*, had a significant bearing on teachers' *confidence* with, and *frequency* of, integration of 21C learning practices in the classroom. Multiple regressions were performed to test the relationships between these categories. An overview of these relationships is provided in Tables 1 and 2, with a detailed explanation of some of these results provided subsequently for illustrative purposes. Only statistically significant relationships have been referenced in these tables.

Table 1: Significant relationships between beliefs, usage and barriers, and confidence.

		Confidence	
		Positive	***Negative***
Beliefs	Direct Transmission		CT, CO, CM
	Constructivist	CT, CM, CO, S	
Opinions and Usage	Knowledge dependent		CT, CO, CM
	Motivating		CM
	Routine usage	CT, CO, CM, CR, S	
Barriers	Classroom management		CT, CO, CM, S

The two scales of Direct Transmission Beliefs (DTB) and Constructivist Beliefs (CB) significantly predicted teachers' levels of confidence with some of the 21C constructs. Results showed that the two-scale belief model was a significant predictor of teachers' levels of confidence to encourage critical thinking (CT), collaboration (CO), communication (CM), and self-direction (S) practices.

Taking Critical Thinking (CT) as an example (F (2, 142) = 6.795, p = .002), Constructivist Beliefs significantly predicted confidence in CT practices: b = 0.209, t (142) = 2.223, p = .028, indicating

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that higher Constructivist Beliefs can act as a predictor of confidence to use CT, insofar as if the belief score goes up by 1, teachers' confidence to encourage the use of critical thinking increases by .209 on the critical thinking confidence scale. Conversely, if the Direct Transmission belief score goes up by 1, teachers' confidence score goes down by 0.202 (Figure 7).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.527	.499		7.075	.000	2.542	4.513
	DTB	-.202	.082	-.201	-2.458	.015	-.365	-.040
	CB	.209	.094	.182	2.223	.028	.023	.395

a. Dependent Variable: CT (confidence)

Figure 7: Multiple regression output from SPSS

Considering some of the other predictors of *confidence* with 21C practices, it appears that regular usage of 21C practices in the classroom (ROU) is positively associated with confidence in facilitating critical thinking (CT), collaboration (CO), communication (CM), creativity and innovation (CR), and self-direction (S) practices.

Conversely, a belief that the success of 21C learning is dependent on the prior levels of knowledge of the students (KND) is a negative predictor of confidence in encouraging critical thinking (CT), collaboration (CO), and communication (CM) practices, as are concerns around classroom management (CLA). Perceptions of classroom management issues also negatively predicts confidence in encouraging practices of self-direction (S) in classrooms.

It is interesting to note that although the overview (Section 1.3.2) indicates that system restrictions (SYS) and resources (RES) were perceived as having the most impact, classroom restrictions are statistically more closely correlated to teachers' confidence. This will be considered in more detail in the discussion section.

Table 2: Significant relationships between beliefs, usage and barriers, and frequency.

		Frequency	
		Positive	***Negative***
Beliefs	Direct Transmission		CM
Opinions and Usage	Knowledge dependent		CO, CM
	Routine usage	*CT, CM, CO, CR, G, S, T*	
Barriers	Classroom management		CM, CR, G, T

Exploring the predictors for and barriers to levels of *frequency* of 21C practices (Table 2), results indicate that classroom management issues (CLA) act as barriers to the frequency of use of communication (CM), creativity and innovation (CR), global connections (G) and technology (T). Direct Transmission Beliefs are negative predictors of the integration of communication practices

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(CM), and a belief that the success of 21C practices is dependent on students' prior knowledge (KND) is negatively associated with the frequency of usage of communication (CM) and collaboration (CO) practices. Unsurprisingly, routine usage (ROU) of 21C practices in the classroom is a significantly positive predictor of the frequency of most of the categories, with only Local Connections (L) not significantly related.

1.3.3 Qualitative Data

For the open-ended item, 82 of the 145 respondents supplied an answer. A process of directed content analysis (DCA) was used to interpret the data.

Using the three constructs in the *barriers* section as coding categories revealed that a majority of respondents found *system restrictions* (SYS) to be the most serious hindrance to the integration of 21C teaching and learning in their practice, making up 40% of all of the coded sections. The SYS category was easily broken down into subcategories relating to time (SYS Time), and Curriculum and Assessment (SYS Curric & Assess). Of these, time constraints were the most significant aspect, with curriculum and assessment constituting a smaller percentage of codes. Issues with *classroom management* made up 17.4% of the codes, and a lack of sufficient *resources* (both physical, and in terms of support), constituted 30%. A final section that did not fit within the predefined barriers was also identified; this related to the beliefs of teachers themselves (BEL Own), as well as those of parents, and other stakeholders (BEL Others), making up 25% of codes (Figure 8).

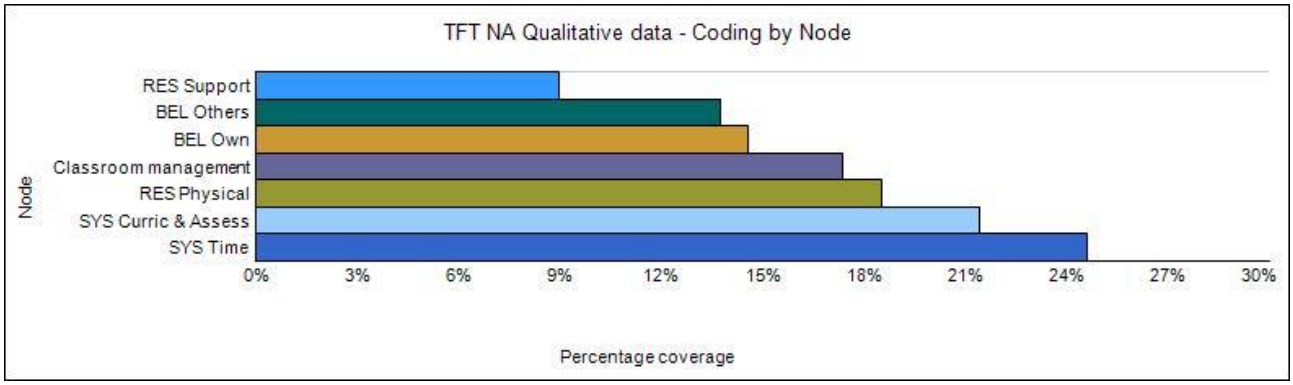

Figure 8: Barriers to 21C learning – % coding by per node

2. Conclusions and Recommendations

The analysis of teachers' responses offered an opportunity to examine various aspects of the respondents' views about 21C practices, providing data to answer the question: what are the predictors for and barriers to confidence and frequency of usage of 21C practices in the classroom? The analysis has given background information relating to beliefs and practices, and has permitted relationships to be established between some of these constructs.

Teachers' mean reported orientation towards 21C practices appears to be quite high; in fact, the respondents tend to agree that 21C teaching and learning has a positive impact on student motivation. However mean levels of confidence are less positive, and mean self-reported frequency of usage is

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only at the low end of the 'monthly' interval (mean score of 2.7). According to the definition of readiness for the integration of 21C teaching and learning as involving *confidence* in using and encouraging, and *frequency* of using, associated practices, this group of teachers is yet not appropriately ready.

Possible reasons for this lack of readiness have also been explored in this study. A number of responses in the qualitative data identified beliefs associated with traditional educational practices as a barrier to the integration of 21C teaching and learning in the classroom; one respondent suggested "*teacher inertia and general reluctance to move from traditional methods*" as a significant issue. While the quantitative analysis reports lower mean levels of *Direct Transmission Beliefs* than *Constructivist Beliefs*, adherence to such traditional beliefs is identified as a significant barrier to frequency of use of technology. On a more positive note, the high mean levels of *Constructivist Beliefs*, evident in all of the participating countries, are positively associated with confidence in the 21C practices of Critical Thinking, Communication, Collaboration, Creativity and Self-direction.

Barriers at the systemic level, particularly those associated with time, and curriculum and assessment, appear to be the most significant. However, while the statistical analysis reflects an opinion that system restrictions and a lack of resources were the most significant barriers to the integration of 21C practices in the classroom, the qualitative data also identify issues with classroom management as very relevant: "*Students are not used to 21C learning, because most of the time they do not have to do it, so at first it takes a lot of time*". In addition, multiple regressions reflect that classroom management issues in particular act as a barrier to teachers' confidence with the 21C practices of Communication and Collaboration, and to the frequency of usage of Technology.

It should be noted that although the samples from each country are small and not representative, and that there were variations in the criteria for participant selection, the results across counties show surprising commonality.

In order to encourage teachers to integrate 21C practices in the classroom, it is essential to address some of the barriers identified in this report. The Teaching for Tomorrow project is attempting to go some way to achieve this. Through the project, the partners are reviewing, adapting and refining an existing framework for 21C teaching and learning – Bridge21 – incorporating transnational best practice in the areas of assessment, approaches to teaching and learning and the development of communities of practice.

Bridge21 is an education programme that has been developed in Trinity College Dublin. It offers a new pedagogic model, and supports an innovative learning environment within schools that is team-based, technology-mediated, project-based, and cross-curricular. Bridge21 offers a structured vehicle for the delivery of 21C learning in the classroom.

This pedagogic approach offers the foundations for the evolution of a comprehensive, and transnational standard for the development of basic and transversal skills in secondary schools. The evolving model of 21C teaching and learning will provide teachers with the structure, confidence and

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knowledge base that they require to successfully impart these skills in a manner that is innovative, yet integrated in the school environment.

The TfT project has developed an online platform (tft-project.eu) providing resources for teachers such as Bridge21 introductory materials, how-to videos and lesson plans for teachers. These online resources provide teachers with an opportunity to engage with 21C teaching and learning practices, without having to generate original material from scratch.

However, simply providing teachers with the new pedagogic method is not enough to ensure change in practice. It is clear from the qualitative analysis in this research, that teachers find it hard to integrate new methods of teaching and learning in an environment that can be resistant to change and is largely focused on the individual educator. Research has shown that Communities of Practice can have a positive impact in this regard, motivating teachers to work in a more collaborative and innovative way (Ardichvili, 2008; Kirschner & Lai, 2007). The TfT project has placed significant emphasis on the development of such communities, both at local and international levels. In this way, the wide variety of skill sets among the teachers can be shared, promoting confidence and increased classroom implementation. Tools such as Google Groups, Facebook, Edmodo and Schoology provide free and accessible platforms for teachers to share lesson plans and review and reflect on classroom experiences.

The features of the TfT model, outlined above, are intended to provide guidance for teachers and students, a structured approach to the development of 21C activities, and a vibrant community of practice. Ongoing research aims to assess the impact that these aspects have on the teachers' readiness to integrate 21C practices, as well as on the barriers identified in this work.

The features of the evolving Bridge21 model, developed by TfT, are intended to provide guidance for teachers and students, a structured approach to the development of 21C activities, and relevant assessment practices.

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