The Role of School Leadership in the Implementation of Programming and Stem Concepts into Classroom Practice

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Abstract

This short practitioner report discussed the role of the school leadership in the implementation of programming, and STEM concepts into classroom practice in an educational institution in Izmir, Turkey. The study investigated the process of how the school's leadership team including the ICT coordinator made it possible to integrate these relatively new concepts into the school's curriculum by effectively managing the change process. 50 teachers from different fields including early years, primary, history, science, mathematics, computing, visual arts and English, were active participants in the implementation program and were asked to regularly reflect on their experiences. The data from teacher's reflective journals showed that both programming and STEM concepts were seamlessly integrated into the schools' curricula and classroom practice. The teachers reported that by receiving training about these concepts and the tools that are necessary for teaching them, was beneficial for supporting the student's development of 21st century learning skills such as collaboration, communication and problem solving. They also explained how the supportive attitude of the leadership team which provided time, resources and training opportunities for teachers, had an impact on the teachers attitude towards the change process.

Key Words: Education Technology, STEM, coding, robotics, ICT, teacher training, leadership

1. Introduction

Until recently, the focus of technology integration in schools were on Information and Communication technologies. The increased interest in teaching children coding and STEM skills, especially the shift from ICT to computer science, has encouraged schools in many countries to consider ways of integrating these concepts into their school curricula. The difficulty is that this implementation process requires both financial and training support for schools which is only possible if the leadership team sees the value in including these concepts in their school' curricula. In a way this explains the difference in schools' responses to technological innovations. MacNeil and Delafield argue that in order to implement technology programs effectively 'School principals must understand the importance of technology for improving school management as well as its implications for improved instruction' (1998, p. 296). Stegall (1998) also supports this and suggests that school principals should model technology use by taking part in service-training, visiting example schools, attending conferences and bringing in experts who would be able to support this process, in other words they should plan in advance how they intend to integrate the new technology into their school.

Fullan (1992) notes that the change process should be planned in advance and address the key aspects that are important for the implementation of the new technology in classrooms. He lists innovation, commitment and support, professional development and leadership as the main aspects that should be considered when planning for the change process. He also notes that, leaders can influence an organisation by creating a shared vision and understanding of the change process, which could contribute to motivating others (Fullan, 2002). Wilmore and Betz (2000) compares the approaches to change management by Fullan (1994) and NSW QA School Review, which highlights the crucial role of the school leadership in this process. Table 1 displays the change management comparison.

Table 1. Change Management (adapted Des Wilmore, & Muhammad Betz. (2000)

Fullan	NSW QA School Review
1. You can't mandate or force change	Provide time, resources and opportunities
2. Change is a journey, not a blueprint	Articulate the purpose
3. Problems are our friends	Organize relevant training and development, establish supporting structures for change
4. Vision and strategic planning come later	Shape and reshape the schools vision
5. Individualism and collectivism have equal power	Nurture the use of innovative and creative solutions
6. Neither centralization nor decentralization work by themselves	Build teams
7. Connections with the wider environment is critical for success	Influence the direction of others
8. Every person is a change agent	Model, advocate and support continuous learning

If we are to apply the main concepts from Table 1 into the implementation of ICT including programming and STEM concepts into the classroom, it is clear that this change process is not about specific tools or software, but equipping teachers with the necessary pedagogical and subject knowledge for engaging their students with their learning (Yuen et al, 2003). This table shows that the change cannot be forced upon teachers, rather they should be encouraged to articulate the purpose of the change and play an active role in the design and implementation of the change process. Furthermore, as Weiss (1994) reports, school leaders should be prepared to provide teachers with continuous teacher training in the focused field. This study will provide an example of how the school's leadership can impact on the attitudes of teachers by planning an appropriate change process to facilitate the implementation of STEM and programming concepts into school's curricula.

2. Method

A qualitative approach was adopted whereby teacher's reflections during and at the end of the implementation period were evaluated to understand the impact of the leadership and their approach to implementing the programming and STEM concepts into the school's curriculum. At the beginning of each month, 50 teachers from different subject fields including early years, primary, history, science, mathematics, computing, visual arts and English, were invited to a training session where they

participated in collaborative learning activities. They were then supported to apply their new learnt knowledge by designing and teaching activities to their class. They were asked to reflect on their journey in a free flow format, especially after each session they taught.

This project took place in a school in Izmir, Turkey. The school has students from diverse socio-economic backgrounds. At the beginning of each month, the monthly training sessions were announced, and teachers were invited to attend these sessions on a voluntary basis. Although the attendance at these sessions was low in the first month, the numbers increased dramatically in the second and third months training sessions. The administrative team members and the leadership team also attended to the CPD sessions with the class teachers. At the end of three months, 80% of teachers (Kindergarten to high school) were trained in 18 different skills set. The teachers were introduced to tools such as Lego robotics, Arduino, Dash board, 3D printer, green screen technology that was planned to use for teaching programming and STEM concepts.

3. Data analysis and Findings

The data from the 50 teacher's reflections were analysed to make sense of their attitudes to the change process and how the leadership team managed it. A thematic analysis approach was used "for identifying, analyzing and reporting patterns within data." (Braun and Clarke, 2006, p. 79). The emerging themes were listed under two categories; positive aspects and barriers. Many teachers mentioned that effective change management practices by the leadership team was the main reason for the successful integration of programming and STEM concepts. Some of the comments that were included by teachers in their reflective journals:

- Having a positive attitude to change

- Being inspired by other teachers and trainers

- Effective modelling by the CPD trainers

- Leaders acting as part of the team

- Leaders adapting mentoring/ coaching approach rather than acting as an instructor

- Being allowed to involve in the design of the CPD sessions

- Opportunities for sharing good practice

- Celebrating success through social media

- Voluntary participation rather than compulsory ones

Under barriers; issues related to environment, funding and number of skilled people were mentioned. Many teachers reported that new technology is expensive, therefore it might be difficult to have all the tools that would make their teaching more engaging. This view started to change when the leadership team explained that it is possible to persuade the school governors to purchase a new technology if it can be proved that it will have an impact on children's learning. The leadership team also highlighted the importance of focusing on pedagogy rather than a tool itself. They encouraged teachers to think creatively when designing activities so that they could make use of what is already available in the school.

One issue that was noted by many teachers was that there are many resources in school but only a few

people have the necessary skills to use them. They suggested that more people should be trained to use the new technology to establish consistency in teaching and learning across the school.

4. Discussion and Conclusion

Our study found that the integration of programming and STEM concepts into school's curricula is a complex process, and it was effective because of the active role that leadership team played and the way teachers were prepared for the change. This was supported by other studies who highlighted the role of the school leadership and the readiness of the teaching staff in technology integration (Dimmock et al. 2013; Thurlings et al. 2014).

Ruis and Parés (1997) suggested that reflection in CPD settings can provide a context for the development of shared practices and values. The findings from the data analysis showed that the teachers enjoyed spending quality time with their colleagues in an informal learning environment. This also strengthened the schools' community spirit where the teachers constantly wanted to share photographs and clips from their training sessions. Some teachers took this further and presented their classroom activities in national and international conferences. In the long term these practices have contributed to the construction of the school's shared values and practices in regard to innovation and change.

Minott (2010) noted that reflection on action, is a key tool for professional development, especially for developing practice through shared experiences. The teachers in this study also found the reflection process to be very useful and continued to reflect on their teaching and the impact of this on children's learning after the project. This has encouraged teachers to think creatively when designing activities to teach STEM and programming concepts and work collaboratively with their colleagues.

The teachers expressed how they felt that they were part of the school community because they were included in the design of the training sessions. This was also useful for meeting the needs of all of the staff. The project also found that the leadership team acted as a coach /mentor during the change process and established a positive relationship with each teacher, valuing their reflections and suggestions. They also used the teacher's reflection points to inform their future actions.

In conclusion we can suggest that the approach of the leadership team to innovations including integration of programming and STEM concepts into a school's curricula has a very strong impact on how it has been perceived by teachers and students. Furthermore, the way that the school leaders manage the change process, will shape the outcome of the integration process. Therefore, the school leaders should develop themselves in both management skills and domain specific subject knowledge such as learning to code in order to make sense of the innovations and to be part of the change process.

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