

COMPARING SCIENCE TEACHERS' INQUIRY VIEWS AND PRACTICES DURING AND AFTER A PROFESSIONAL DEVELOPMENT PROGRAM

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The purpose of this study is to record the lasting effect of a professional development (PD) program on in-service science teachers' inquiry views and practices. The PD program aimed to familiarize participants with current trends of Science Education (SE), putting emphasis on the inquiry approach. The basic research question that guided us is: Did science teachers' views and practices about inquiry change long after (more than 4 years) their participation in the particular PD program and in what way? Teachers' views and practices will be recorded at least four years after they completed the one year-long PD project. Their views were recorded through structured questionnaires before their teaching and reflective interviews after teaching observations, while their practices will be assessed through a semi-quantitative teaching observation protocol. Teachers' views will be content analysed and teachers' practices will be processed by a semi quantitative method. Results indicate that teachers' views are positive about inquiry approach in genera but inquiry implementation is often affected by contextual factors.

Keywords: Science Education, Inquiry-based teaching, Teaching Practices

INTRODUCTION

Current trends of science education (SE) suggest that in-service teachers need to teach in innovative ways that may differ from their own experience as students (Shaharabani & Tal, 2017). Additionally, it is expected that teachers throughout their professional life, will acquire and upgrade their teaching skills, integrate modern teaching strategies, and seek information about the evolution of knowledge produced in the subject (Donaldson, 2010). In this sense, many professional development (PD) programs are designed to help teachers develop their knowledge, skills, beliefs and practices in order to improve students' learning (Luft & Hewson, 2014). Findings of education and psychological research emphasize the need to integrate practices that enhance inquiry learning in SE (Authors and colleagues, 2016) and rise concerns about effective professional learning trying to introduce or empower innovative teaching approaches such as inquiry (Bakkenes et al., 2010). Many of these studies point out the need of PD programs to address both teachers' views and practices (Capps et al., 2012). However, there is limited scientific knowledge about the long-term impact of PD programs, and especially of those that study the impact on both views and practices that teachers ultimately apply in their daily teaching practice (Shaharabani & Tal, 2017).

In this context, the goal of the present study is to assess in-service science teachers' level of inquiry views (IV) and practices (IP) long after their participation in a PD program focusing on inquiry. The research

question guiding us is: Did science teachers' IV and IP change four years their participation in the specific PD program and if they did, in what way?

METHODOLOGY

Four teachers (3 females, 1 male) are engaged in the study, equally balanced from each educational level: two (2) primary (T1 & T2) and two (2) secondary (T3 & T4). All four of them had participated in a yearlong PD program, four years ago. All participants now have 11-28 years of teaching experience in public schools. According to the research design, participants will be interviewed and observed for a minimum of three teaching sessions. Teachers' IV is a complex variable consisting of a) IV about inquiry approach in general as well as b) IV about inquiry practices they implement. Teachers' IV will be recorded by a) a pre-teaching questionnaire and b) a semi-structured interview after their teaching sessions. Teachers' IP will be recorded by a semi-quantitative observation protocol. The same research tool was also used to record teachers' IP during the PD program, so the findings of this study will be directly comparable with those from the PD program (Authors and colleagues, 2020). The pre-teaching questionnaire is structured, comprised of two sections, aiming to provide information about teachers' IV (a+b). The first section is based on a Likert type scale, which is a suggested way of incorporating a degree of sensitivity and differentiation of participants' responses, while also providing quantitative data (Cohen et al., 2008). The second section includes open-ended questions allowing in-depth research through personal explanation of participants (Cohen et al., 2008) regarding possible factors affecting their IV (a+b). Additionally a semi-structured reflective interview guide was also developed to record teachers IV (a+b) after teaching observation. Interviews are a commonly used method in education research, allowing deeper and more enlightening perception of specific areas of interest (Cohen et al., 2008). The guide is consisted of eight (8) questions focusing on teaching design and method, possible difficulties teachers might face e.t.c. (e.g. *What factors did you take into account in your teaching design?*). Depending on teachers' answers, additionally clarifying questions may be asked, such as "*why do you say that?*" or "*can you give us an example?*". Teachers' IP will be recorded using a semi-quantitative observation protocol (OP) (Authors and colleagues, 2020). The OP follows a top-down approach, recording the frequency of occurrence of specific IP in a three-point scale (1=rarely, 2=sometimes, 3=usually) (Authors and colleagues, 2016). Two observers will independently score the OP for each teacher. For each practice the average occurrence frequency will be calculated. Frequencies of teachers IPs during and about four years after the PD program will be compared and discussed.

RESULTS

Initial questionnaires were given in October of 2020, before teaching observations would have taken place which had been planned for November of 2020. Participants completed the initial IV questionnaires which were sent via e-mail. In some case, some additional explanations were needed, that were gained through Skype interviews with teachers. Indicative teachers' IV deriving from the pre-teaching questionnaire are presented in Table 1. However, due to COVID19 restriction measures and the transition to distance learning for both primary and secondary schools, the observation of teachers' was postponed. As soon as conditions in schools return to some degree of normality, data collection and analysis for both IV & IP will be completed to be presented at the conference.

DISCUSSION

Records of teachers' initial IV (a) are indicative of good theoretical knowledge (Q1) and satisfactory readiness for implementation –self views about their practices (Q2). Teachers' intentions are positive to multiple inquiry approaches e.g. strengthening students autonomy and active student learning (Q3). The most common difficulties mentioned are context related, e.g. time pressure and lack of equipment (Q4), which are consistent with other studies (Bevins et al., 2019). Additional IV data deriving from reflective interviews combined with data about IP will provide firm conclusions.

Table 1. Teachers' IV pre- teaching questionnaire

Questions	Teacher 1	Teacher 2	Teacher 3	Teacher 4
Q1: How would you characterize your theoretical knowledge about inquiry? <i>Likert scale: from 1 (minimum) to 7 (exceptional)</i>	6 <i>very good</i>	5 <i>satisfactory</i>	5 <i>satisfactory</i>	6 <i>very good</i>
Q2: How would you characterize your readiness to implement inquiry teaching? <i>Likert scale: from 1 (not ready at all) -7 (fully confident)</i>	6 <i>I am confident enough</i>	5 <i>Ready to a satisfactory level</i>	5 <i>Ready to a satisfactory level</i>	5 <i>Ready to a satisfactory level</i>
Q3: Do you think you have modified your views concerning innovative ways of teaching such as inquiry because of your prior experience to the PD program?	T1: give more opportunities for inquiry & strengthening students' autonomy	T2: inclusion of information research and experiments & linking teaching with students everyday experiences	T3: active student learning	T4: encourage students to make assumptions & active student learning through inquiry activities
Q4a: Have you faced any difficulties in an effort to implement new practices? Q4b: Have you maintained any of you previous V or P about teaching and why?	T1: context reasons e.g. time pressure and lack of equipment (<i>difficulties</i>)	T2: use of interactive textbook as guide (<i>maintenance</i>), executing experiments as demonstration by teacher or limited group of students (<i>difficulties</i>)	T3: lack of materials and time pressure restricts experiments to demonstration (<i>difficulties</i>)	T3: lack of materials and time pressure (<i>difficulties</i>) leads often to lecturing (<i>maintenance</i>)

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REFERENCES

- Authors and colleagues (2016). Details omitted for double-blind reviewing.
- Authors and colleagues (2020). Details omitted for double-blind reviewing.
- Bakkenes, I., Vermunt, J., Wubbels, T. (2010) Teacher learning in the context of educational innovation: Learning activities and learning outcomes of experienced teachers. *Learning and Instruction* 20 (6), 533-548.
- Bevins, S., Price, G., & Booth, J. (2019). The I files, the truth is out there: science teachers' constructs of inquiry. *International journal of science education*, 41(4), 533-545.
- Capps, D. K., Crawford, B. A., & Constan, M. A. (2012). A review of empirical literature on inquiry professional development: Alignment with best practices and a critique of the findings. *Journal of Science Teacher Education*, 23(3), 291-318.

- Cohen, L., Manion, L., & Morrison, K. (2008). *Research methods in education (Greek Version)*. Metaixmio.
- Donaldson, G. (2010). *Teaching Scotland's Future: Report of a review of teacher education in Scotland*, Scot Gov, Edinburgh.
- Luft, J. A., & Hewson, P.W. (2014). Research on teacher professional development programs in science. In N. G. Lederman & S. K. Abell (Eds.), *Handbook of research on science education* (Vol. 2, pp. 889–909). NY: Routledge.
- Shaharabani, Y. F., & Tal, T. (2017). Teachers' practice a decade after an extensive professional development program in science education. *Research in Science Education*, 47(5), 1031-1053.