# Preservice Physics Teachers' Challenges in Implementing Context-Based Argument Driven Inquiry Activities

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**Abstract**. The researchers of this study designed and implemented Context-Based Argument Driven Inquiry (CADI) in an elective undergraduate course for prospective physics teachers (PPT). Seven PPTs enrolled in this course will have acted both as teacher implementing CADI and learners carrying out CADI activities. Data sources include video recordings of classroom implementation, group interviews with students, midterm examination, reflection papers and laboratory reports. Based on the analyses of the data, we will talk about the difficulties that students acting as a teacher face during implementation of CADI and of learners while carrying out CADI activities. Suggestions and implications will be presented.

## 1 Introduction

Scientists, to be able to explain natural events in the universe, make claims and prove them via taking data from observations and experiments. The way of making bridge between data and claims, and presenting proofs is named as argumentation in science education literature[1]. Argumentation is an activity which develops students' scientific literacy[2] and builds explanations, models and theories[3]. Recently, Argument Driven Inquiry (ADI) has been introduced as a new instructional model[4]. This model gives key role to argumentation particularly in laboratory-based instruction[5].

It is our belief that physics, as other sciences, should be learned by carrying out inquiry-based experiments. According to DeBoer, ultimate purpose of the science educators during the 30 years since 1950s was inquiry[6]. The situation does not seem to change since that time. The inquiry-based learning method adopts constructivist theory, which emphasizes learners' active construction of the meaning, and basically involves asking questions that are then subjected to scientific research. Inquiry-based methods have too important benefits for students to be ignored. Research studies shows that inquiry-based learning has positive effects on students' science process skills[7], attitudes towards science[7] and self-efficacy[8].

In traditional approach, physics is presented in a didactic way as collection laws and formulas divorced from real-life to be memorised. However, physics is not just a collection of laws and formulas. It presents explanations to events, objects around us and interactions between them. For this reason, physics should be taught in a manner in which its connection with learners' lives is made clear. Context-based learning approach can be utilized for this purpose. It is defined, at its broadest meaning, as the social and cultural environment in which the student, teacher and institution are situated and at its narrower meaning, learning with a context which is the application of physics topic[10]. According to Whitelegg and Parry[9], when an appropriate context is used learning process becomes "less didactic, more negotiated and may meet the students' social needs, and promote students' self-esteem and prestige."

In light of above discussions, it is logical to expect that when combined together, argumentation, inquiry and an appropriate context will result in better knowledge and skill development in learners. Our main goal is to bring all three together to present a new model of physics teaching: CADI – Context-based Argument Driven Inquiry. For this goal, we have developed lessons to be used in real classroom settings. For the purpose of this study, we wanted to investigate how PPTs would perform, both as a teacher implementing CADI lessons and as students carrying out CADI activities. In this regard, we set out the following research questions:

RQ1: What are the challenges of PPTs in acting as teachers implementing CADI lessons?
RQ2: What are the views of PPTs acting as learners about CADI?

## 2 Methods

For the purpose of this study, an elective course was re-designed to implement CADI activities developed by the researchers. However, we made two main changes to the ADI model. Firstly, we modified the type of inquiry. In original ADI, students carry out experiments to confirm knowledge given by the teacher. In CADI, type of inquiry will be open/guided inquiry depending on the level of learners. Secondly, we added context to the model, because of the reasons discussed earlier.

This study is being carried out with seven PPTs enrolled in the said elective course. Five of them were senior students and two were Master of Science students. Course materials were developed beforehand by the researchers. The first week course was an introduction to argumentation, context-based learning approach, and inquiry-based learning. In the following weeks, each PPTs will in turn play the role of a teacher to implement a CADI lesson while the remaining PPTs will carry out CADI activities as learners under the guide of that teacher. PPTs acting as teachers go over the teacher guide before their teaching week with the first researcher. They have one week to prepare for the CADI lesson. The CADI lesson were developed on optics unit, which is in $10^{th}$ grade Turkish physics curriculum. Astronomy was chosen as the context.

Each group and the PPT acting as the teacher in each CADI lesson are being video recorded as the main data source for research question one. Also, we conduct group interviews following week to reflect on previous weeks' lesson. Before coming to the interviews, PPTs will fill-in a reflection sheet containing fixed set of questions. Video recordings and these reflections sheets will be used as data sources for the second research question. Additionally, PPTs acting as learners' lab reports, midterm exam and observations will also be used as data sources to answer the research questions.

## 3 Conclusion

Based on the analyses of the data, we will talk about the challenges that students acting as a teacher face during implementation of CADI and of learners while carrying out ADI activities. Suggestions and implications will be presented.

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