Workshop on evaLuation and assEssment in softwARe eNgineers' Education and tRaining (LEARNER)

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ABSTRACT

Software engineers need to acquire a rich set of soft and hard skills in order to be able to deliver high-quality software systems that meet stakeholders' needs. Such a skill set can be acquired through different educational and training approaches: from formal education in schools and universities to workplace training and capstone projects, from offline classes to those online, from coding clubs to boot camps and contests, up to the use of any resource or technology for the education and training of present and future software engineers.

These educational and training approaches need to be assessed by educators or trainers. To do so, it is needed to compare the desired or expected learning outcomes with the actual results. LEARNER 2024 is a workshop interested in any aspect concerning the evaluation and assessment of educational and training approaches for present and future software engineers. Contributions aiming to evaluate and assess the skills above-mentioned, as well as engagement and retention in the education and training of software engineers, are also of interest to the workshop.

KEYWORDS

Education, Training, Software Engineering, Software Testing

1 MOTIVATION

1.1 Objectives

Software engineers need to acquire a rich set of soft and hard skills in order to be able to deliver high-quality software systems that meet end-users' and customers' needs. A few examples of these soft skills are problem-solving, teamwork, stress management, and decision-making. On the other hand, the hard skills (*i.e.,* technical skills) include (but are not limited to) software programming, software testing, conceptual modeling, hardware and software technologies, artificial intelligence, and software development methodologies. The aforementioned skill set can be acquired through different educational and training approaches, from formal education in schools and universities to workplace training and capstone projects, from offline classes to those online, from coding clubs to boot camps and contests, up to the use of any resource or technology for the education and training of present and future software engineers. These educational and training approaches need to be assessed by educators or trainers. To do so, it is needed to compare the desired or expected learning outcomes with the obtained learning results.

The LEARNER (evaLuation and assEssment in softwARe eNgineers' Education and tRaining) 2024 workshop aims to bring together researchers, educators, and trainers from both academia and industry to discuss and advance the state of the art on the evaluation and assessment of education and training of present and future software engineers. In other words, the goal of LEARNER is to assess and evaluate educational and training approaches to let software engineers acquire the required soft and hard skills, as well as to experiment (and then assess and evaluate) novel educational and training means, including the use of any resource or technology for educational and training purposes of software engineers. LEARNER 2024 is also interested in evaluating and assessing both soft and hard skills required to software engineers, as well as engagement and retention (*e.g.,* gender balance) in the education and training of software engineers.

1.2 Intended Audience

We expect a mixed audience of researchers, educators, and trainers from both academia and industry worldwide to share and discuss findings resulting from the evaluation and assessment in the context of education and training of present and future software engineers within schools, universities, workplaces, *etc.* We will use both traditional (*e.g.,* mailing lists and personal contacts) and social networking channels (*e.g., Twitter* and *LinkedIn*) to advertise LEARNER 2024. Moreover, we will ask the program committee members to advertise the workshop.

1.3 Topics of Interest

LEARNER 2024 encourages contributions covering any topic related to (quantitative, qualitative, and mixed) research in the context of software engineers' education and training. The topics of interest include, but are not limited to:

- Educational and training methods for acquiring hard (*e.g.,* software programming, software testing, artificial intelligence, conceptual modeling, hardware and software technologies, software

development methodologies, *etc.*) and soft skills (*e.g.,* problem-solving, stress management, teamwork *etc.*) required to software engineers;
- Role of soft skills and human factors in the education and training of software engineers;
- Measurement of hard skills, as well as soft skills required to software engineers;
- Pedagogical approaches supporting software engineers' education and training in distributed and remote settings;
- Education and training of software engineers in university and workplace settings;
- Online platforms and software tools specifically designed or simply used for education and training purposes of software engineers;
- Continuous training of software engineers;
- Engagement and retention (*e.g.,* gender balance) in software engineers' education and training.

1.3.1 Special Theme. LEARNER 2024 will have a special theme, namely: **Software Testing Education and Training**. Software testing is one of the most effective ways to measure functional quality. A simple search on LinkedIn reveals the increasing demand for software-testing professionals over the past years. However, current Information-Technology (IT) curricula do not educate students to become good testers. The identified problems in the current IT curricula follow: (1) testing is often introduced too late, when bad habits (for example, not testing their own code) are already developed; (2) there is a lack of dedicated courses on software testing; (3) students (and lecturers) often lack the motivation to do good testing and see the subject as boring (even though many times they see the value); and (4) a systematically-developed body of knowledge with didactic approaches, educational settings, and learning outcomes on software testing is lacking. Without the proper education and motivation, after graduation, students arrive at IT companies unprepared, contributing to delivering low-quality software systems.

Fortunately, educators all over the world are developing components for innovative educational programs in software testing that meet the needs of higher education to foster quality awareness. These components need to be assessed in order to understand whether, or not, the desired or expected learning outcomes are achieved. To bring evidence on this matter, the first edition of LEARNER has Software Testing Education and Training as a special theme. A keynote speech related to this theme will take place to encourage discussions about the evaluation and assessment in software testing education and training.

We encourage submissions on the topics of interest for this specific theme, which include, but are not limited to:

- Educational and training methods for software testing;
- Models, methods, and techniques for evaluating the effectiveness of software testing education;
- Evaluation on innovative software testing teaching processes;
- Role of soft skills and human factors in the education and training of software testers;
- Metrics, measures, and assessment techniques to evaluate knowledge in testing courses;
- Tools specifically designed for education and training of software testing;
- Any means for improving software testing education and training not listed above.

We would like to clarify that the special theme is a way to encourage submissions on a specific topic, related to the evaluation and assessment in software engineers' education and training, and then have a discussion about this theme during the workshop. In other words, submissions covering any topic related to research in the context of software engineers' education and training (thus not related to the special theme) are welcome.

1.4 Relevance

Studying Software Engineering and acquiring its related (hard and soft) skills open different job opportunities; for instance, software engineers can specialize as software testers, software architects, project managers *etc.* Besides these "traditional" job opportunities, there are emerging areas like, for instance, artificial intelligence and software security, which offer new job opportunities for software engineers. Nowadays, software engineers can be found in different working environments, from industry to academia and research, from government to business organizations. The demand for software engineers is expected to increase in the next years since current software systems need to evolve and be maintained while new software systems will be released. However, Software Engineering is not easy to teach and learn, and it is not accessible to everyone; moreover, its related (hard and soft) skills are not easy to acquire. Understanding how to improve aspects related to learning, teaching, and accessibility of this discipline, including the acquisition of its related (hard and soft) skills, is of primary relevance to educators, trainers, and researchers, and even more to the labor market, which demands an ever-increasing number of software engineers having a rich set of soft and hard skills. Gathering empirical evidence by using quantitative, qualitative, and mixed research is a necessary step to increase our body of knowledge in software engineers' education and training. Given the expertise of EASE attendees in empirical research in Software Engineering, we believe the EASE community can provide valuable feedback about the evaluation and assessment in the software engineers' education and training context, including software testing education and training (*i.e.,* the special theme of this year).

1.5 Context

LEARNER 2023 was the first edition of the workshop co-located with EASE conference, held in Oulu, Finland. LEARNER 2023 was performed during 1 day, including a keynote, 6 accepted papers, and a guided discussion. LEARNER 2023 had more than 25 participants and provided rich discussions with the participants. Figure 1 presents some of the attendees to the workshop in the afternoon.

The website of LEARNER 2023 is available at: https://unibas3d.github.io/learner/.

LEARNER 2024 will be the second edition of the workshop.

2 ORGANIZATION

The organizers of LEARNER 2024 are active researchers in Software Engineering, and lecturers in that field. They bring different

Figure 1: Participants LEARNER 2023 afternoon.

expertise in research, practice, and teaching; and all share a great interest in software engineers' education and training. A brief biography of each organizer follows.

Tanja E.J. Vos (Open Universitiet The Netherlands and Universitat Politécnica de Valencia, Spain): Prof. Dr. Tanja E. J. Vos has more than 20 years of experience with formal methods and software testing. She has been appointed professor of Software Engineering at the Open University since January 2016 and is also a lecturer at the Computation and Information Systems Department (DSIC) of the UPVLC. Moreover, she is the director of the Test Engineering group at the ProS centre, where she is involved in various research projects on software testing in an industrial setting. Moreover, she has successfully coordinated and participated in various EU-funded projects, from FP6, to H2020 to ITEA. She is currently coordinating the open-source TESTAR.org project. She has been involved in setting up successful workshops on testing, like A-TEST from the beginning since 2009, and has been involved in many other workshop and conference organization committees.

Anna Rita Fasolino (University of Napoli Federico II, Italy): she is an Associate Professor at the Department of Electrical Engineering and Information Technology of the University of Napoli Federico II, Italy. Her research interests include software testing, GUI and Mobile app testing, reverse engineering, Web engineering, and embedded software engineering. In such fields, she developed and participated in numerous R&D projects and co-authored more than 100 articles published in IEEE/ ACM international journals, books, proceedings of conferences and workshops. Prof. Fasolino serves as a member of the program committee and collaborates in the organization of international conferences, including ICST, ICSE, ICSM, ENASE, INTUITEST, and INTUITESTBEDS. She is a member of the editorial board of scientific journals in this field, including the Journal of Systems and Software, Array, PeerJ Computer Science, and MDPI Computers, MDPI Software.

Beatriz Marín (Universitat Politècnica de València, Spain): Dr. Beatriz Marín has more than 10 years of experience in teaching, academic management, and leading research projects. She has been project manager in companies, senior researcher, professor of undergraduate and graduate students, director of research projects, and during the last 3 years, coordinator of research and master degree at Universidad Diego Portales - Chile. Nowadays, she is working as senior researcher of the Valencian Institute of Artificial Intelligence (VRAIN), Spain. She has more than 50 scientific articles in the software engineering area, particularly in the areas of conceptual modeling, software testing, model-driven software development, empirical software engineering, and gamification. She participates actively in scientific committees of national and international conferences, and also in journals of recognized prestige.

Felix Cammaerts (KU Leuven, Belgium). Felix Cammaerts is a PhD student at the Research Centre for Information Systems Engineering (LIRIS) at KU Leuven. Actively researching and developing tools to teach students to test and understand their models within Model-Driven Engineering.

Mehrdad Saadatmand (RISE, Sweden): is a Senior Researcher in software engineering at RISE Research Institutes of Sweden in the city of Västerås where he also leads the Software Testing Group. Mehrdad holds a Ph.D degree from Mälardalen University in Sweden. He has extensive experience of working in various collaborative industrial research projects, particularly several large-scale European ones. He is also acting as the Research Area Leader of Software Engineering and Testing at RISE. Mehrdad has also been the general chair of AST 2023 conference, and also served as the publication chair of ICST 2018.

2.1 Workshop Program Committee

If the workshop proposal is accepted, we will invite the following people (*i.e.,* the program committee is not finalized yet):

- Burak Turhan, University of Oulu, Finland;
- Ugo Erra, University of Basilicata, Italy;
- Rita Francese, University of Salerno, Italy;

- Davide Fucci, Blekinge Institute of Technology, Sweden;
- Marcela Genero, University of Castilla-La Mancha, Spain;
- Alessandro Marchetto, University of Trento, Italy;
- Sabato Nocera, University of Salerno, Italy;
- Giuseppe Caggianese, National Research Council, Italy;
- Gordon Fraser, University of Passau, Germany;
- Monique Snoeck, KU Leuven, Belgium;
- Christoph Bockisch, Philipps-Universität Marburg, Germany;
- Erik Barendsen, Radboud Universiteit, Netherlands;
- Wishnu Prasetya, Utrecht University, Netherlands;
- David García Solórzano, Universitat Oberta de Catalunya, Spain;
- Porfirio Tramontana, University of Napoli Federico II, Italy;
- Riccardo Coppola, Politecnico di Torino, Italy;
- Isabel Brito, Polytechnic Institute of Beja, Portugal;
- Giancarlo Guizzardi, University of Twente, Netherlands;
- Andy Zaidman, Delft University of Technology, Netherlands;
- Lilian Scatalon, Universidade de São Paulo, Brazil;
- Vahid Garousi, Queen's University Belfast, UK;
- Eduard Enoiu, Mälardalen University, Sweden;
- Keith Quille, Technological University Dublin, Ireland;
- Alexandra Mendes, University of Porto, Portugal;
- João Pascoal Faria, University of Porto, Portugal;
- Nuno Flores, University of Porto, Portugal.

3 WORKSHOP FORMAT

3.1 Planned Deadlines

The deadlines of LEARNER 2024 are:

- The submission deadline is March 8th, 2024;
- The acceptance notification is on April 12th, 2024;
- The camera-ready deadline is April 26th, 2024;
- The early-registration deadline for authors is May 5th, 2024.

3.2 Intended Paper Format

The authors have three options for submitting their papers.

- **Research paper** (max 10 pages). They must describe empirical research (*i.e.,* quantitative, qualitative, and mixed research) on topics related to software engineers' education and training (see Section 1.3). Negative-results papers are welcome as long as they can support advice or lessons learned. Papers reporting replications of empirical studies are welcome as well.
- **Experience-report paper** (max 5 pages). They must describe an experience on topics related to software engineers' education and training. Unlike research papers, experience-report ones do not leverage empirical research (*i.e.,* quantitative, qualitative, and mixed research) to distill findings. Experience-report papers are of interest as long as they provide an interpretation of the experience in terms of lessons learned and actionable tips. The topics of interest are listed in Section 1.3.
- **Ongoing-research paper** (max 5 pages). They must describe ongoing research on topics related to software engineers' education and training (see Section 1.3). The purpose of these papers is to communicate new ideas in the context of software engineers' education and training for which the authors want to obtain early feedback from the workshop community, especially on the evaluation and assessment strategies. An ongoing-research paper must describe the idea as well as the proposed evaluation and assessment strategy possibly (but not necessarily) with some preliminary results. For example, an ongoing-research paper can present a novel educational approach or a software tool for education and training purposes of software engineers students along with the planned evaluation and assessment strategy.

Engagement: The extent to which the paper can engage the workshop attendees in a discussion.
Presentation: The extent to which the paper's organization and quality of writing meet the high standards of EASE. That is, the paper should be well-structured, employ clear and correct scholarly language, avoid ambiguity, include clearly readable figures and tables, and be appropriately formatted.
Relevance: The extent to which the paper is relevant to LEARNER.
Significance: The extent to which the paper's findings can impact the education and training of present and future software engineers, and under which assumptions (if any).
Soundness: The extent to which the paper's findings or authors' research plans are based on the rigorous application of appropriate research methods.
Verifiability: The extent to which the paper includes sufficient information to support independent verification or replication of the paper's findings. This includes the public availability of research data or an explicit statement about why such data cannot be made publicly available.

Table 1: Evaluation criteria description.

The page limit (we reported above) for each kind of submission is intended for the entire paper—*i.e.,* it includes references, figures, tables, appendices, and any other additional material. Any submission exceeding the corresponding page limit will be desk-rejected.

3.3 Evaluation Process

LEARNER 2024 will employ a double-blind review process. Any paper must be written in English, contain original unpublished work, and use the official ACM Primary Article Template (https://www.acm.org/publications/proceedings-template) in aligment with the requirements for EASE. Deviating from the ACM formatting instructions may lead to desk rejection.

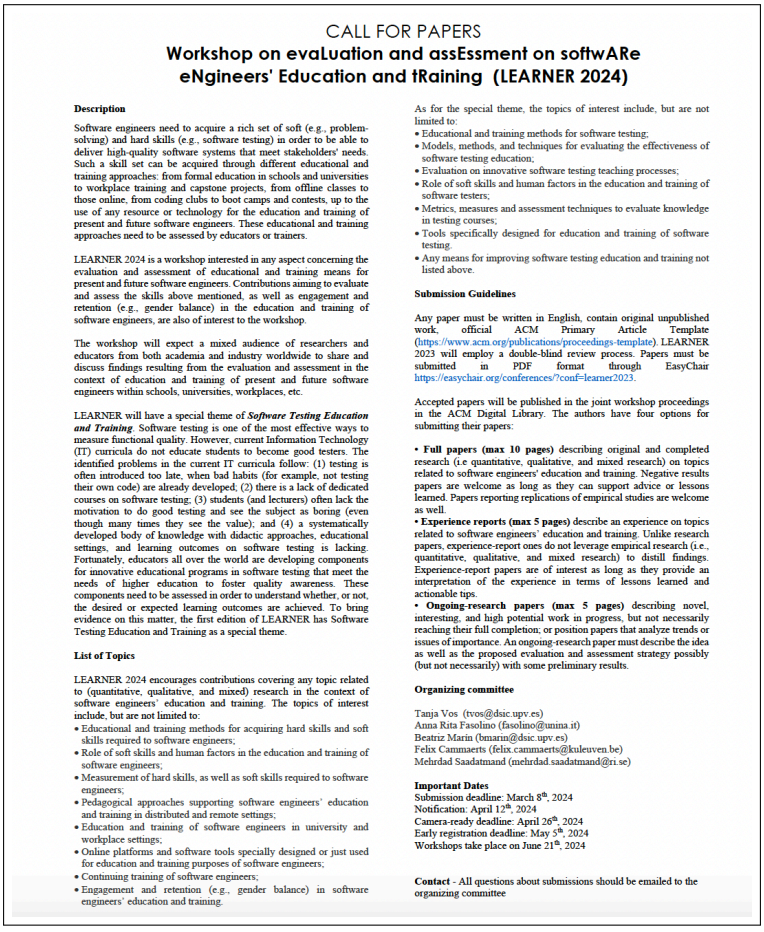
As for the submission and review process, we plan to use Easychair. Each paper will undergo a review process, receiving at least three reviews from the members of the program committee. Following the reviews, there will be online discussions, and finally, the organizers will make final decisions on paper acceptance, by using both reviews and conclusions of the discussions. Accepted papers will be published in the joint workshop proceedings in the ACM Digital Library.

Based on their category, submitted papers will be evaluated against more criteria (see Table 1) as follows.

- **Research Papers** will be evaluated against: engagement, presentation, relevance, significance, soundness, and verifiability.
- **Experience-report papers** will be evaluated against: engagement, presentation, relevance, and significance.
- **Ongoing-research papers** will be evaluated against: engagement, presentation, relevance, significance, and soundness.

3.4 Intended Workshop Format

At least one author of each accepted paper must attend the workshop and present the paper. We expect five to ten paper presentations. During the workshop, we will encourage the interaction



CALL FOR PAPERS

Workshop on evaLuation and assEssment on softwARe eNgineers' Education and tRaining (LEARNER 2024)

Description

Software engineers need to acquire a rich set of soft (e.g., problem-solving) and hard skills (e.g., software testing) in order to be able to deliver high-quality software systems that meet stakeholders' needs. Such a skill set can be acquired through different educational and training approaches: from formal education in schools and universities to workplace training and capstone projects, from offline classes to those online, from coding clubs to boot camps and contests, up to the use of any resource or technology for the education and training of present and future software engineers. These educational and training approaches need to be assessed by educators or trainers.

LEARNER 2024 is a workshop interested in any aspect concerning the evaluation and assessment of educational and training means for present and future software engineers. Contributions aiming to evaluate and assess the skills above mentioned, as well as engagement and retention (e.g., gender balance) in the education and training of software engineers, are also of interest to the workshop.

The workshop will expect a mixed audience of researchers and educators from both academia and industry worldwide to share and discuss findings resulting from the evaluation and assessment in the context of education and training of present and future software engineers within schools, universities, workplaces, etc.

LEARNER will have a special theme of ***Software Testing Education and Training***. Software testing is one of the most effective ways to measure functional quality. However, current Information Technology (IT) curricula do not educate students to become good testers. The identified problems in the current IT curricula follow: (1) testing is often introduced too late, when bad habits (for example, not testing their own code) are already developed; (2) there is a lack of dedicated courses on software testing; (3) students (and lecturers) often lack the motivation to do good testing and see the subject as boring (even though many times they see the value); and (4) a systematically developed body of knowledge with didactic approaches, educational settings, and learning outcomes on software testing is lacking. Fortunately, educators all over the world are developing components for innovative educational programs in software testing that meet the needs of higher education to foster quality awareness. These components need to be assessed in order to understand whether, or not, the desired or expected learning outcomes are achieved. To bring evidence on this matter, the first edition of LEARNER has Software Testing Education and Training as a special theme.

List of Topics

LEARNER 2024 encourages contributions covering any topic related to (quantitative, qualitative, and mixed) research in the context of software engineers' education and training. The topics of interest include, but are not limited to:

- Educational and training methods for acquiring hard skills and soft skills required to software engineers;
- Role of soft skills and human factors in the education and training of software engineers;
- Measurement of hard skills, as well as soft skills required to software engineers;
- Pedagogical approaches supporting software engineers' education and training in distributed and remote settings;
- Education and training of software engineers in university and workplace settings;
- Online platforms and software tools specially designed or just used for education and training purposes of software engineers;
- Continuing training of software engineers;
- Engagement and retention (e.g., gender balance) in software engineers' education and training.

As for the special theme, the topics of interest include, but are not limited to:

- Educational and training methods for software testing;
- Models, methods, and techmques for evaluating the effectiveness of software testing education;
- Evaluation on innovative software testing teaching processes;
- Role of soft skills and human factors in the education and training of software testers;
- Metrics, measures and assessment techniques to evaluate knowledge in testing courses;
- Tools specifically designed for education and training of software testing.
- Any means for improving software testing education and training not listed above.

Submission Guidelines

Any paper must be written in English, contain original unpublished work, official ACM Primary Article Template (https://www.acm.org/publications/proceedings-template). LEARNER 2023 will employ a double-blind review process. Papers must be submitted in PDF format through EasyChair https://easychair.org/conferences/?conf=learner2023.

Accepted papers will be published in the joint workshop proceedings in the ACM Digital Library. The authors have four options for submitting their papers:

- **Full papers (max 10 pages)** describing original and completed research (i.e quantitative, qualitative, and mixed research) on topics related to software engineers' education and training. Negative results papers are welcome as long as they can support advice or lessons learned. Papers reporting replications of empirical studies are welcome as well.
- **Experience reports (max 5 pages)** describe an experience on topics related to software engineers' education and training. Unlike research papers, experience-report ones do not leverage empirical research (i.e., quantitative, qualitative, and mixed research) to distill findings. Experience-report papers are of interest as long as they provide an interpretation of the experience in terms of lessons learned and actionable tips.
- **Ongoing-research papers (max 5 pages)** describing novel, interesting, and high potential work in progress, but not necessarily reaching their full completion; or position papers that analyze trends or issues of importance. An ongoing-research paper must describe the idea as well as the proposed evaluation and assessment strategy possibly (but not necessarily) with some preliminary results.

Organizing committee

Tanja Vos (tvos@dsic.upv.es)
Anna Rita Fasolino (fasolino@unina.it)
Beatriz Marin (bmarin@dsic.upv.es)
Felix Cammaerts (felix.cammaerts@kuleuven.be)
Mehrdad Saadatmand (mehrdad.saadatmand@ri.se)

Important Dates

Submission deadline: March 8th, 2024
Notification: April 12th, 2024
Camera-ready deadline: April 26th, 2024
Early registration deadline: May 5th, 2024
Workshops take place on June 21st, 2024

Contact - All questions about submissions should be emailed to the organizing committee

Figure 2: Draft call for papers.

and exchange of ideas among the participants by explicitly devoting ample time to discussion sessions. More in detail, we envision the workshop format that follows.

- **Opening session.** It consists of a brief opening speech (with a duration of about ten minutes) held by the organizers, followed by a keynote speech about the special theme of LEARNER 2024 (we expect 45 minutes for the keynote speaker presentation and 15 minutes for questions and answers).
- **Paper sessions.** Here, the authors will present their papers to the audience. The presentations of the accepted papers will be arranged in more paper sessions depending on their number and corresponding theme—*e.g.*, papers on the special theme will be arranged in the same paper session. We estimate 15 minutes for presenting research papers, and 10 minutes for the other cases. Right after the presentation of each paper, there will be a five-minute discussion about that paper.
- **Discussion session.** It consists of a discussion on the evaluation and assessment in software testing education and training (*i.e.*, the special theme) or a round table (lasting about 45 minutes). More in particular, we will involve all participants in the discussion by asking them to share their knowledge and experience related to the special theme.
- **Closing session.** Here, we will wrap up (in about 15 minutes) the outcomes of the discussion about the special theme.

3.5 Expected Number of Participants

We expect a mixed audience of researchers, educators, and trainers in Software Engineering—given the co-location with EASE—from both academia and industry. In total, we expect ten to 25 participants in the workshop.

3.6 Needed Equipment

For the workshop, we need basic equipment and services. For instance, we need a conference room that can host about 25 participants with a whiteboard, computer, projector, and chairs for the attendees. We also need coffee breaks between the workshop sessions.

4 ADDITIONAL MATERIAL

4.1 Draft Call for Papers for the Workshop

The draft call for papers for the workshop is shown in Figure 2.