An Initial Analysis of the Research on Interest and Introductory Programming

A Systematic Review of this Literature

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***Abstract*— This Research Full Paper presents a review of the literature related to novices' interest in learning to code. Students' interest in this topic has been mentioned in the Computer Science Education (CSE) field since the 1990s. Although it got the attention of computing faculty and shaped a wide number of proposals, students' disinterest remains a complex struggle in Computer Science (CS) courses. On the other hand, we still have little knowledge about what theoretical concepts and methods of research are adopted by researchers who study interest, particularly among novices in programming. As an attempt to close this gap, we carried out a systematic review process to identify frequent assumptions and methodological decisions aiming to establish a sense of what happened in the last seventeen years in this research field. Based on our review, the findings revealed that although a high number of contributions is propagated, most of them are based on lesson learned reports that fail in producing reliable evidences to substantiate the effectiveness of some proposals. The analysis of the 36 publications considered relevant to our systematic review revealed that there is not a convergent understanding between CSE researchers of what is interest and how to measure. Not many of them study interest based on specific theories or observe how students' interest changes over time. So, although we have found many publications referring to practical and experimental applications, we could see that this research area is still fragmented and led by a bit of uncertainty about what really can sustain novices more interested in learning coding.**

Keywords*— *interest; novices; programming education; systematic review.

I. Introduction

Interest is an important motivational factor in learning because of its potential to strengthen the engagement with the learning setting [1]. The level of interest will drive how individuals define goals, stay focused, persist and realize the effort required to succeed [2][3]. Interest plays a relevant role in learning because it supports engagement [4]. As [5] mentioned: "We tend to pursue endeavors we enjoy". Interest shapes how we perceive a particular course of study [6].

Over the last decades, substantial efforts were undertaken to develop resources aiming to promote experiences that could raise novices' interest in learning to code. As a result, a wide literature was formed towards research on interest and introductory programming. As many studies suggest approaches to meet the goal of raising novices' interest in learning to code, we were encouraged to comprehend in greater details this literature, including what motivational theories researchers adopt and the knowledge built over the years in this area. To the best of our knowledge there is not much research that critically reviewed this specific state-of-the-art. Therefore, this work is an initial attempt to structure the existing body of literature related to the research on novices' interest in coding; raise common thoughts used by CSE researchers and draw a bigger picture about this research community, since we understand that it is important to get a glance at the maturity and feasibility of some proposals spread in this literature.

This paper describes a study of the literature related to students' interest in learning programming considering the last seventeen years (2000 to 2017). It is structured as follows: section II describes the systematic review process; section III presents the results and discusses the findings; section IV describes the threats to validity; section V presents a brief discussion and section VI summarizes some conclusions and future work.

II. Method of Research

In this section, we detail the process for conducting our systematic review that followed the guidelines proposed by [7].

A. Research questions and data sources

Based on the goal for this research, we defined the following research questions:

RQ1: In this literature, what motivational theories are the studies based on?

RQ2: What have researchers studied most?

RQ3: How are studies methodologically designed?

The process of searching focused on the most relevant publication venues of the CSE. Aiming to reach representative results, we selected the following databases: ACM Digital Library, IEEExplore, Springer, Education Resources Information Center (ERIC) and Semantic Scholar.

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B. Query definition and selection of publications

The search terms were formulated by taking into account our research questions. We selected both keywords interest and introductory programming to run exploratory searches. Next, synonyms for these keywords were defined to formulate the string used during the automatic searches:

("motivation" OR "interest" OR "engagement") AND ("learn" OR "learning" OR "teach" OR "teaching") AND ("introductory programming" OR "CS0" OR "CS1") AND ("programming" OR "code" OR "coding") AND ("undergraduate" OR "higher education" OR "college" OR "university") AND ("computer" OR "computing")

Searches occurred during September of 2017 and resulted in almost 3000 papers, not all of them useful. In order to conduct a selection process, we stated the inclusion and exclusion criteria listed above:

- Papers should have been published between 2010 and 2017;
- Publications must be related to the theme targeted by the systematic review process: novices' interest in learning to code;
- To be included, the paper should deal with the domain of computer science;
- It excluded short papers (less that 5 pages); those classified as reports, position, philosophical or opinion papers and all that were not freely available;
- Publications not including a description of its methodological design were excluded;
- It ignored those that were not primary research papers, such as literature reviews and meta-analysis work;
- Studies related to online education and not targeting introductory courses of programming were disregarded as well;

The selection process was conducted in two steps. First, we applied criteria considering the title, keywords and abstract of publications. Duplicated papers were identified and discarded. As a result, 160 papers were pre-selected. Two of the researchers voted to classify each paper as relevant or not. The third researcher was designated to vote when conflicts occurred. Table I summarizes the numbers that resulted in each step of the selection process.

TABLE I. NUMBER OF PAPERS RETRIEVED AND KEPT AFTER APPLYING INCLUSION/ EXCLUSION CRITERIA

Source	Found	Pre-selected papers	Relevant papers
IEEExplore	20	12	4
Semantic Scholar	1560	75	15
ACM digital Library	863	51	10
Springer	304	6	0
ERIC	25	9	2
Science Direct	141	8	1
Total	2913	160	32

All 160 publications were read. At that point, some papers did not meet some of the criteria. Others reported the same research over multiple papers. We decided to keep some of those publications to gather more details related to the goal of our systematic review. When papers did not have complementary information, they were excluded. Four relevant papers were identified by using the snowball technique. After this second cycle of selection, the resulting number of publications was reduced to 36.

C. Data extraction

Aiming to answer the research questions, the following data was retrieved from the papers: title, authors, year of publication, country where the research was carried out and was published. We also intended to scrutinize how research was methodologically designed.

Therefore, we organized a matrix to list: goals and research questions; some important details of the research method, including the nature of the research method; interval of data collection; method of data analysis and findings claimed by authors. To classify the type of the studies, we use the taxonomy proposed by [8] (and further applied by [9]) as it is presented in Table II.

TABLE II. RESEARCH TYPE FACETS AS IT IS MENTIONED IN [9]

Category	Description
Validation research	Techniques investigated are novel and have not yet been implemented in practice. Techniques used are for example experiments, i.e., work done in the lab
Evaluation Research	Techniques are implemented in practice and an evaluation of the technique is conducted. That means, it is shown how the technique is implemented in practice (solution implementation) and what are the consequences of the implementation in terms of benefits and drawbacks (implementation evaluation)
Solution proposal	A solution for a problem is proposed, the solution can be either novel or a significant extension of an existing technique. The potential benefits and the applicability of the solution is shown by a small example or a good line of argumentation

The analysis of papers was not only descriptive but also qualitative in terms of reasoning about what aspects might establish strengths and weakness to this research field. Next, we present our findings.

III. FINDINGS

In the following sections we describe the results of the systematic review process. Table III presents the year distribution of the relevant studies considered in this study. The year of 2015 has the largest number of publications.

TABLE III. YEAR WISE DISTRIBUTION

Year	Papers
2001	[10]
2002	[11]

2007	[12]
2008	[13]
2009	[14] [15] [16]
2010	[17] [18] [19]
2011	[20] [21] [22] [23]
2012	[24] [25] [26] [27] [28]
2013	[29]
2014	[30] [31] [32]
2015	[33] [34] [35] [36] [37] [38]
2016	[39] [40] [41] [42]
2017	[43] [44] [45]

The majority of the relevant studies were published in conference proceedings. Most of papers appears on the ACM Technical Symposium on Computer Science Education (SIGSCE), followed by the ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE) (see Table IV).

TABLE IV. PUBLICATION VEHICLE WISE DISTRIBUTION

Publication vehicle	Papers
ACM Technical Symposium on Computer Science Education (SIGCSE)	[11] [12] [13] [17] [21] [23] [35] [39] [41]
ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE)	[10] [16] [19] [44]
ACM Inroads Magazine	[20]
ASEE Annual Conference & Exposition	[29]
Australasian Conference on Computing Education	[14]
Computers & Education	[27]
Computers in Human Behavior	[30] [32]
EDUCON - Global Engineering Education Conference	[31]
Frontiers in Education Conference (FIE)	[45]
International Conference on Computer Science & Education (ICCSE)	[33]
Games Innovations Conference (ICE-GIC)	[15]
ACM Conference on International Computing Education Research (ICER)	[40] [43]
IEEE Transactions on Education	[37]
International Conference on Intelligent Tutoring Systems	[26]
International Convention on Information and Communication Technology, Electronics and Microelectronics	[34]
International Symposium in Information Technology	[18]
Journal of Computing Sciences in Colleges	[22] [42]
Journal of Problem Based Learning in Higher Education	[36]
Procedia - Social and Behavioral Sciences	[28]
SIGITE - Annual conference on Information technology education	[24]
TOCE - ACM Transactions on Computing Education	[25] [38]

The systematic review process revealed the USA as the country with the highest incidence of research targeting this subject (Table V).

TABLE V. COUNTRY WISE DISTRIBUTION

Country	Papers
Australia	[14]
Brazil	[44] [45]
Canada	[38]
Costa Rica	[31] [36]
Croatia	[34]
France	[26]
Malaysia	[18] [28] [33]
Portugal	[27]
Scotland	[17]
Spain	[30] [32]
United Arab Emirates	[24]
United Kingdon	[10] [37]
USA	[11] [12] [13] [15] [16] [19] [20] [21] [22] [23] [25] [29] [35] [39] [40] [41] [42] [43]

The number of research classified as experience papers was an intriguing trend in this literature that caught our attention. This type of work is focused on explaining what and how something was done, but evaluation relies on author's personal experiences and lessons learned [8]. Among the 2913 papers returned after executing the search, about 800 of them were excluded from this systematic review for having been classified as such. This matter is worth emphasizing given the limitation of those publications in matter of providing stronger evidences to support authors' claims. Others were excluded for not meeting the criterion of displaying details of its methodological design.

Considering the 36 relevant papers, they were also organized based on the classification scheme proposed by [8] and further applied by [9], which was shown previously in Table II. Considering this set of papers, about 35% were classified as evaluation research paper, 30% as validation research, 25% as solution proposal paper and less than 10% as theoretical work.

A. In this literature, what motivational theories are studies based on?

Overall, we noticed that CSE researchers had no concerns of adopting theoretical interpretations to substantiate investigations about students' interest, sometimes handling this construct imprecisely and indistinctly, similar to the concept of enjoyment, engagement or motivation.

In 28 papers authors did not mention any specific theory (or theoretical framework) directly related to interest or motivation – since both are considered overlapping constructs for scholars. Considering those in what authors not only mentioned but used some theory (n=8), the most common was the Self-Determination Theory by Deci [46] (n=2), followed by the Four-Phase Model of Interest Development by Hidi and Renninger [47] (n=2) (Table VI). Other theories mentioned in papers, although not directly related to our central construct, were: Bloom's taxonomy [48] (n=1), Bandura's social-cognitive theory [49] (n=1), Achievement-goal Theory [50] (n=1) and Intelligence Theory [51] (n=1).

TABLE VI. WHAT IS INTEREST ACCORDING TO DIFFERENT THEORETICAL FRAMEWORKS

According to…	interest…
Self-Determination Theory	is related to intrinsic motivation. Deci [46] states that "intrinsic motivation is evident when an activity is performed for its own sake and out of interest and curiosity. Interest refers to doing something because it is inherently interesting or enjoyable".
Four-Phase Model of Interest Development	"…a unique motivational variable, as well as a psychological state that occurs during interactions between persons and their objects of interest, and is characterized by increased attention, concentration and affect." [47]

This inquiry reveals thought-provoking results. We identified a remarkable gap between authors and existing theories on interest (or motivation). The little amount of researchers studying this motivational concept grounded on established theories is something to be aware especially when we consider how interest is an intricate educational construct. According to [52]: "interest is a widely used concept with manifold facets". Its interrelation with other motivational constructs may lead to multiple ways in which a researcher can interpret and investigate phenomena around it. Besides that, interest tends to manifest and fluctuates itself over time as a reaction to existing circumstances such as the classroom environment [53]. Given this intricacy, it is essential that researchers assume a theoretical assumption, so they can properly design methods and strategies to study certain phenomena related to that construct and, mainly, evaluate how their interventions impact changes in novices' interest in learning to code.

B. What have researchers studied more?

About 90% of papers were classified either as validation research, solution proposal or evaluation research. Accordingly, we can say that contributions are more empirical that conceptual in nature. Frequently, authors realize interest as an attribute of the learning setting which means "interestingness as characteristic of the learning context". Due to that, most papers (n=33) referred to efforts to improve tasks, pedagogical processes and use technology to make the setting more attractive and engaging (Table VII). Consequently, as we could see, computer science research is mostly grounded on a technical perspective to mitigate novices' lack of interest. Table VII contains a big picture of what areas have been most covered by researchers and the number of papers related to each one. This table contains some excerpts to enlighten how some of them think about the research goals to be fulfilled. We realized that the use of robots, games (including gamification) and systems of feedback (online judges, intelligent assistants or tutoring programs, for instance) are the most predominant topics.

There is significant interest among researchers in understanding how to improve tasks and projects in programming to make them more interesting and less frustrating as well. Pedagogical strategies are mostly built under the Problem-Based Learning (PBL) approach and its variants. In addition, leveraging the social component of learning seems to be valued by many educators who adopt practices, such as collaborative and team-based teaching as alternatives to raise their students' interest in coding. Apparently, flipped classroom is a promising approach that has not been extensively explored in CSE yet. Although, it is worth recalling that this observation was built considering that we found a few papers discussing this approach but just one fit the criteria of this systematic review.

TABLE VII. ILLUSTRATION OF RESEARCH GOALS FOUND IN PAPERS

#	**Feature**	Excerpts
Tasks		
3	Assignments	"… a study on the factors that make students interested in programming assignments" "…this paper describes the introduction of a feedback-revision-resubmission cycle for homework assignments […] to increase student engagement."
2	Projects	"... to collect and analyze some initial data on how engaging and frustrating our students find our programming project."
Use of technology		
6	Robots	"... the purpose of this study was to determine whether using the IPRE robots motivates students to learn programming in a CS0 course."
1	Augmented reality	"... to discuss a pilot course in mobile AR intended to strengthen student development skills and interest in computing."
5	Games/gamification	"... using games as a motivational tool that can stimulate their interest in computer science and help them become more engaged in their studies."
Pedagogical approach		
1	Active learning	"... to stimulate student interest, motivation, and satisfaction through a lab-based and project-based course development to promote active learning pedagogy."
3	Collaborative learning	"…the aim of this study is to evaluate student's motivation using CIF and MoCAS as CSCL materials."
6	Feedback	"an intelligent assistant has been proposed to […] increase motivation, time that students spend in learning

		programming and to make learning process more interesting."
3	Problem-Based Learning	"this paper reports on a two-year study involving our project – involving the Problem-oriented Animated Learning modules, designed to enhance student engagement […]"
1	Flipped classroom	"… we explain how this approach combined with a flipped class and gamification has led to high levels of student engagement […]"
1	Peer instruction	"We present a new approach to help make computer science more social and effective. Lightweight teams are class teams where there is a significative component of peer teaching, peer learning […]."
1	Competition	"…provide new learning strategies to motivate students and present programming as an easy and attractive challenge. […] This paper discusses the students' satisfaction and their academic performance after using this competitive educational on-line tool."

While many studies turned efforts to the learning setting, few of them focused on understanding students' interest under a holistic perspective, considering, for instance, multiple factors that affect how they experience being interested (or not) in learning to code.

We also noticed a shortage of theoretical work in this literature. Only three researchers chose to follow this route. Margolis and Fisher [11] studied female students over four years at Carnegie Mellon University to understand how the experience at an undergraduate course affected their interest in programming. Jenkins [10] surveyed students at two UK universities to reveal why they chose to study an IT degree. The author observed if their motivation changes during the first year and what caused the shifts. The research highlighted several issues surrounding the motivation of programming students. Scaico et al. [44][45] studied Brazilian freshmen students to comprehend changes in their interest during a semester. The authors recreated students' interest in form of trajectories to observe it from a dynamic point of view. They also discussed influential factors that played a role as inhibitors and facilitators in how beginners felt interested in learning to code. The environment of learning was pointed out as a relevant vector for shaping interest. However, as the authors explained, a number of individual factors created an ecosystem of influences that moderated how beginners interpreted the learning environment in terms of its complexity and novelty, and also, their own self-efficacy in learning.

Over the last five years, we also noticed there has been an increase in the number of CSE researchers who have been more concerned about how psychological factors affect the process of learning to code, above all self-efficacy beliefs, mindset, self-directed learning and competencies of study like self-regulation.

C. How methodologically are these studies designed?

Most of the relevant studies (80%) are quantitative. Surveys emerged as the most common instrument of data collection. However, we noticed that some researchers adopted multiple instruments (see Table VIII). The majority of them developed surveys by themselves and not many discuss strategies to validate instruments. As an exception, [27] and [41], for instance, mentioned the use of Cronbach's alpha tests. This scenario might pose a concern to what is claimed in some publications, especially when we are attentive to what [25] points out: "[…] many tools exist for measuring motivation, but not all tools meet the criteria for being valid and reliable survey instruments. Researchers can develop their own tools, but this requires knowledge about survey construction, scale development, length, and format".

TABLE VIII. DATA COLLECTION INSTRUMENTS

Instrument	Occurrence in data
Grades	11
Surveys	26
Semi-strutured interviews	5
Self-reports (written thoughts or emotional responses about engaging with tasks or experience with a teaching intervention)	3
Qualitative analysis of source-code	6
Observation	4
Diaries	2
Focal groups	1

On the other hand, as [5] states: "the latent nature of interest makes the challenge of obtaining valid measures of this construct". Koballa and Glynn [54] also mentioned that high-quality assessment of important educational outcomes can be puzzling, particularly in the case of psychological constructs like interest. In addition, they discuss that despite the volume of work, in general, researchers and educators who use a survey to assess interest might face a number of pitfalls, especially when they are not explicitly informed by well-established theoretical frameworks that are important to preserve validity issues. Valid and reliable measures of affective outcomes like students' interest are scarce [55].

This is particularly more critical in the domain of CSE. Through this systematic review, it was clear that in some works authors were more interested in evaluating how satisfied students were when being exposed to some intervention than observing specifically how the interaction impacted their interest (or motivation). That is aligned to what [56] stated: "… sometimes CSE researchers' efforts to assess are no more than attempts to evaluate treatment through some scientific analysis".

As far as we know, few scholars use specific instruments to measure interest and its stages of development in the domain of introductory programming. Also, we learned that in the few studies that adopted validated instruments to assess students' interest. In part, this might be explained because many researchers would rather adopt motivation as the most common terminology to refer to the motivational aspects of learning.

An adaptation of the Instructional Materials Motivation Survey (IMMS) was mentioned by [25] and [40] to assess students' reaction to instructional material. This scale is based on four constructs: attention, relevance, confidence and satisfaction. The Situational Motivation Scale (SMS) was used in [30] for measuring the four dimensions of motivation according to the Self-Determination Theory. Cutts et al. [17] and Lishinski and colleagues [57] adopted the Motivated Strategies for Learning Questionnaire (MSLQ), a Likert-scaled instrument designed to measure motivation and use of learning strategies. The Dweck's general mindset measure was used as a motivation scale in [17] and [41]. In [43], the authors developed a questionnaire to collect students' emotional reactions based on the previous work of [58]. Elnagar and Ali [59] adapted a questionnaire created by [60] to gather students' feedback about their experiences with practices of team-based learning.

Still considering the set of papers driven by a quantitative method, most of them were based on cross-sectional data collection designs (26 papers). Ten papers mentioned a longitudinal one. The most common length of data collection was one academic semester. However, data collection processes ranged between less than one week up to four semesters. In some publications this information was not stated. Due to the fact that cross-sectional data collection is broadly practiced, the use of pre- and post-tests was also noticed frequently. Despite the technical potential to produce more interesting environments to learn programming, the drawback in this field seems to fall upon the lack of interest in assessing how students' interest in learning to code changes over time.

Data analysis processes relied on trivial statistics tests. Most of the analysis was descriptive in nature. In several publications authors did not state hypotheses they wanted to test. Table IX shows some excerpts from those who had the hypothesis tests as the starting point to their studies.

TABLE IX. HYPOTHESES STATED BY SOME AUTHORS

Paper	Hypotheses
[32]	"The experimental hypothesis that we tested was that certain emotions (specifically, ''anger'') would be lower in these ''unmotivated'' texts"
[26]	"The discovery part is important for motivation and learning and requires a exploration time for players"
[27]	"H1: The students who use the EduJudge system will obtain higher final exam scores (and thus, improve their academic performance) than those students who do not use it. H2: The level of satisfaction of students with higher computer skills will be higher than that of the students with lower computer skills when using the EduJudge system. H3: The level of satisfaction of women will be different than that of men when using the EduJudge system."
[22]	"Are my introductory programming students truly most interested in mild challenges? "If I did give my students a choice of programs, what factors would most affect their choice?" "Challenges (tasks) just at the edge of our comfort zone are the most interesting?"
[20]	"We hypothesize that how students' attitudes are affected may be linked to class status, previous programming experience or initial self-efficacy"

IV. Threats to Validity

Some issues were threats to our systematic review, especially due to biases that needs to be considered. One issue is the process of publication selection. It is not possible to guarantee that all relevant publications related to the target of this systematic review were reached. Due to our intention to obtain a very specific view about what exists in the domain of CSE, the search string was devised based on three central terms: interest, motivation and engagement.

Important publications could be disqualified during the judgment of inclusion and exclusion criteria. Since interest is a fuzzy concept, with multiple understandings, combined with the lack of authors' theoretical assumptions, the analysis might have been biased, especially because we understand that interest, motivation and engagement are distinct concepts. The existence of a third researcher was a strategy adopted to mitigate this threat. The data collection was delimited by automatic searches and the databases used. Then, our results cannot be generalized. However, they reflect a reasonable overview of what is in this field.

V. Discussion

Our findings show that both educators and researchers recognize how important it is to cultivate interest to keep beginners engaged while learning programming. Over almost two decades, substantial efforts have been employed to turn teaching settings into something more appealing. However, we could notice through this study that it is unclear how all the endeavors really impact students and promote longer-term changes in their interest in learning this topic. It was difficult for us to endorse the claims of some authors who assumed to have developed effective solutions to foster growth of students' interest in learning to code.

Many initiatives were planned to raise students' interest. However, their measurement processes were not always properly designed to establish a precise gauge of effectiveness. Measuring interest is a challenging process because it requires theoretical foundation to support methodological choices of tools and strategies of assessment. Looking at how some studies considered in this review were planned, we noticed that many evidences are anecdotal, at best.

As [25] exposed: "In several introductory programming studies, motivation is discussed and claims are made, but motivation is not defined and claims cannot be supported. In a study using games as a tool for learning programming, for example, [61] claimed that their instructional framework enhanced student motivation because 60% of students "had fun learning programming" and preferred their method over other assignments. In another study, students were asked about their motivation levels in a one-item Likert scale response [62]". McGill also affirmed that unlike what many researchers claim, using robots to teach novice students is minimally effective compared to those who are already inclined by their natural interest in programming. Hays [63] realized the same outcome when studying the literature of instructional games.

Torrey [22] said that "there are a few studies on student interest specifically in the programming setting". This interpretation is true when we consider that interest is an educational construct broadly studied as the same of motivation. Although both constructs are strongly related, they are different [64]. That means that even students highly motivated are interested in specific things. In the research involving this topic it still remains unknown how the interest in programming changes across the learning trajectory and what type of factors might nurture or inhibit its development. The Four-Phase Model of Interest Development by [47] – a framework that explains the stages in what a learner's new interest develops – was found in only one research [44] [45].

There is a low number of research built on previous work which might reflect some limitation for this field advances knowledge and evolves some of the existing proposals too. Our findings met the results found in [65] who looked at the theoretical underpinnings of computing education research.

We also could notice a shortage of research using a student-centered approach to investigate interest in learning to code. However, we could realize a trend toward investigating human factors that affects students' interest in learning coding from papers published in the last five years. There is still little research related to aspects involving, for instance, the gender of students and the training of CS educators in terms of how to cultivate their students' interests.

VI. Conclusions and Future work

Other researchers have been studying the literature of how the research on CSE has been developed over the last decades. In this paper we also aimed to reinforce the importance of discussing some issues to close a gap related to the research on motivational factors and introductory programming. So, we contribute by developing an initial, specific and critical notion of the state-of-the-art of this literature. We were motivated to understand the conceptual and methodological decisions of scholars to establish a sense of what happened in the last seventeen years in this research field.

Lack of theoretical background was exposed by many publications considered in this study. This may be a consequence of the research culture built over decades that overvalues technical aspects and quantitative research questions, underestimates empirical studies and stands aloof from theories from other fields. Several other scholars, as [66], had expressed the need for the computing education community to investigate certain issues within a theoretical framework. As a result, some questions remain open, especially those related to why some circumstances occur in experiences of developing interest in learning programming.

The present work was an attempt to organize some knowledge towards this research topic. It analyzed past research in order to shed light on more effective methods of garnering students' interest in coding. Some of the aspects mentioned establish a downside to this research area, since the analysis pointed to the existence of open-questions that must be considerate so the CS community can underpin this knowledge base and master better designs of teaching programming.

Our preliminary findings show the need for further investigation. It is important to carry out future studies to conduct an in depth inquiry in many papers that was excluded from this systematic review. That is the case of dozens of publications classified as lesson learned papers. Studying them is a way to identify some trends and compare them to existing frameworks. We also have a special interest in understanding how the existing theoretical work has been used in this field. Finally, it is a goal of ours to expand this study to consider the existing research in the last twenty years.

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