Jurnal Fundadikdas (Fundamental Pendidikan Dasar)
Vol. 6, No. 3, November 2023, pp. 198-211
ISSN 2614-1620
http://journal2.uad.ac.id/index.php/fundadikdas

Coding for Indonesian elementary school students: parents' perceptions

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Received: July 6, 2023 *Revised: October 9, 2023* *Accepted: November 26, 2023*

KEYWORDS
Coding skills; Elementary school students; Parental perceptions; Information and Communication Technology; Mutual collaboration

ABSTRACT

In the digital era, coding skills have become increasingly prevalent and are now taught in schools. This paper aims to illuminate parents' perceptions of coding education for elementary school students in Indonesia. The study focuses on eight parents who enrolled their children in a coding school in Central Java, Indonesia. To gather data, open-ended questionnaires and semi-structured interviews were conducted. The collected data were subsequently analyzed thematically. The study revealed that parents held positive perceptions of coding skills for elementary school students. This positivity stemmed from their awareness of the rapid development of Information and Communication Technology (ICT), the anticipation of the future impact of ICT skills, trust in the institution, and their children's interest in ICT. Furthermore, parents expressed positive perceptions of their children's progress, attributing it to improved coding skills and positive attitudes. They emphasized the importance of mutual collaboration and communication between parents and schools to enhance the learning experience. In addition to offering a coding curriculum, the school provided parents with up-to-date information about ICT through seminars and regular digital content distribution. The collaboration between the school and parents extended to establishing rules regarding the use of mobile phones and PCs to prevent potential harms from excessive device usage. This suggests that the success of coding education for children necessitates effective collaboration between parents and schools.

Introduction

The expansion of information and communication technology (ICT) into various aspects of human life has prompted educational institutions worldwide to incorporate ICT subjects and computational thinking skills into their curricula. Computational thinking, defined as a conceptual foundation necessary for efficient and effective problem elucidation (algorithmically, with or without computer assistance) with reusable solutions in diverse

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contexts, is a key aspect (Shute *et al*., 2017). Among the computational thinking subjects introduced to young learners are coding skills, now integrated into various learning activities. Coding involves problem-solving processes that activate the resolution of computational problems and is considered an instrumental skill within computational thinking (Arfé *et al*., 2019). These coding skills serve as the foundation for further exploration in programming to develop digital applications. Typically, coding skills for young learners are cultivated through game-like activities, such as block games, fostering problem-solving abilities.

Over the past decade, European countries, Australia, some Asian countries, and the United States have initiated the inclusion of coding skills in their education systems, starting from primary and even kindergarten levels (García-Peñalvo *et al*., 2016; Kurniawati *et al*., 2019; Mason & Rich, 2019; Rich *et al*., 2019; Wong *et al*., 2015). This trend reflects the belief that these skills will hold significance and impact for the future youth generation. Educational systems that integrate technology-based services and systems have gained popularity as well (Qureshi *et al*., 2021). Education must equip individuals with the necessary competencies to meet current societal needs and develop quality human resources capable of facing future challenges. Given the automation of many human activities in the era of globalization and advanced ICT, education must respond by providing coding and other ICT skills. Governments, industry leaders, and policymakers have acknowledged the importance of aiding young people in enhancing computational thinking as a valuable skill for participating in a digitally mediated society. This recognition extends to education, policymakers, and industry stakeholders, highlighting the need for awareness and action in preparing the younger generation to initiate new ideas, express themselves in diverse ways, and navigate the evolving landscape of advanced digital technologies (Yu & Roque, 2018).

In the Indonesian context, the national implementation of ICT subjects still encounters various challenges, primarily stemming from the inequity in education facilities and human resources. Additionally, ICT is not a compulsory subject in the primary education system (Hermawan *et al*., 2018). Consequently, only students in privileged regions and schools have the opportunity to learn ICT. Highlighting schools with commendable facilities and ICT focus, one such institution is SD ICT Al Abidin in Surakarta, Central Java, Indonesia. This elementary school not only covers the national curriculum but also incorporates a coding curriculum, utilizing multiple coding applications. Operating under a private education institution offering ICT skills subjects and coding curriculum from elementary to senior high school, the focus on the elementary school context is intriguing. Despite the young learners' limited independence, the progress in coding for this age group is reported to be excellent (Arfé *et al*., 2019; Çiftci & Bildiren, 2020). Early childhood is deemed particularly opportune for cultivating interests in

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computing, supporting cognitive, social, and emotional skill development (Clements & Gullo, 1984). Numerous studies indicate that early interventions can have lasting effects, influencing academic and personal outcomes later in life (McCoy *et al*., 2017).

However, education isn't confined to the interaction between students and teachers; active parental involvement is essential both in the home learning context and in providing feedback on teaching and learning programs at school. Generally, parents exhibit positive attitudes toward their children's ICT use, particularly endorsing its educational purposes (Gür & Türel, 2022). Choosing a school that integrates coding and other ICT skills into its curriculum, rather than merely employing them as learning tools, demands heightened participation from parents to supervise their children. ICT, akin to a tool, can either benefit or harm individuals. Therefore, the question arises: how should coding skills and other ICT skills be imparted to young learners at the elementary school level? Despite the positive impacts documented in numerous studies, it is crucial to assess how Indonesian parents perceive the substance of these skills, understanding both their benefits and potential harms. Examining parental perspectives on these issues and exploring ways in which parents and schools can collaborate becomes essential to fostering positive impacts and skill development during children's formative years.

Research on parents' perceptions and involvement in ICT content remains limited (Rabah, 2015). investigated the benefits and challenges of ICT integration in Québec English Schools, highlighting advantages such as localizing 21st-century education and enhancing the learning process. Challenges included inconsistent investments in ICT equipment, infrastructure, and resources, a lack of supportive school leadership, and the need for additional professional development in evaluations and curricular plans. Mwalongo explored parents' perceptions of ICT integration in education and its impact on school choice in private pre-primary schools in Tanzania (Mwalongo, 2015). The study revealed that effective ICT integration required full parental involvement, as most parents had positive perceptions, believing that ICT skills would benefit their children in future employment. Despite the high cost of attending private schools with ICT integration, parents considered it an economic investment.

Ramírez-Rueda *et al*. (2021) carried out a comparative analysis of preschool and primary education teachers' and parents' perceptions of a coordinated vision of ICT in education. It reported that both parents and teachers had a highly positive assessment of ICT, specifically in making teaching-learning processes more interesting even though it sometimes took a greater time and effort. Some important issues were highlighted such as the importance of improving the professional training of educators to use ICT effectively in the classroom and the need to provide mutual communication between schools and parents to convey the possible benefits and threats of using ICT. Furthermore, children may learn coding in different ways at school

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and home, and therefore educators and parents need to apply different approaches and strategies (Unahalekhaka & Bers, 2021). In the Indonesian education context, (Kurniawati *et al*., 2019) investigated the curriculum content, challenges, and strategies in managing a formal coding school for the elementary education level in Indonesia. It reported that the school utilized several open-source coding applications and integrated them with the national curriculum. One of the challenges they found was the lack of parents' recognition of the importance of coding skills and ICT and how it could have meaningful impacts on their children in the future. Therefore, the school intensively conducted various programs both offline and online to introduce coding skills to parents.

Of the previous studies, it is clear that there is a gap in terms of there is no study so far investigating parents' perceptions of coding school in the Indonesian context. Previous studies concerning parents' perception and/or involvement took the contexts of other countries which have different characteristics from Indonesian. Those studies didn't focus on coding skills as a school subject and a part of curriculum content but looked at the integration of ICT in general into classroom practices and teaching-learning activities. Those studies also didn't explore the parent's and schools' collaboration to succeed in the learning programs. This current study investigates parents' perception of the integration of coding skills in the elementary school context in Indonesia, by focusing on three key terms: (1) their perceptions of coding skills for elementary school students which drove them to the decision to choose the coding school for their students; (2) their perceptions on the children's progress; and (3) the parents and the school's contributions in succeeding the learning programs for the children.

Method

This case study utilized open-ended questionnaires and semi-structured interviews for data collection, avoiding the use of numbers in the data collection and analysis. Both methods were selected to gather both general and detailed information from the research participants, as illustrated in the flow chart. Although 10 parents were invited, only 8 agreed to participate in the study. The 8 participants included 6 women and 2 men, aged 29-47 years old, with diverse backgrounds such as lecturer, teacher, housewife, and entrepreneur. All parents were active users of mobile phones and social media. The study followed a structured process. Initially, participants were invited to join the research and received an explanation about the research topic and purposes. Once they confirmed their willingness, they completed an open-ended questionnaire sent via Google Forms. Obtaining consent from participants regarding data collection and research purposes aligns with ethical research conduct (Barkhuizen *et al*., 2014). After collecting all data, a thematic analysis was conducted. Subsequently, three

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participants were chosen for semi-structured interviews to gain more detailed information and for triangulation purposes. The selection of these participants considered the diversity of occupations and ages. Conclusions were drawn after completing all analyses. The open-ended questionnaire and semi-structured interviews were conducted in Indonesian. Following data analysis, selected quotes presented in the findings section were translated into English. Fig. 1 depicts the flow chart of the study for data mining.

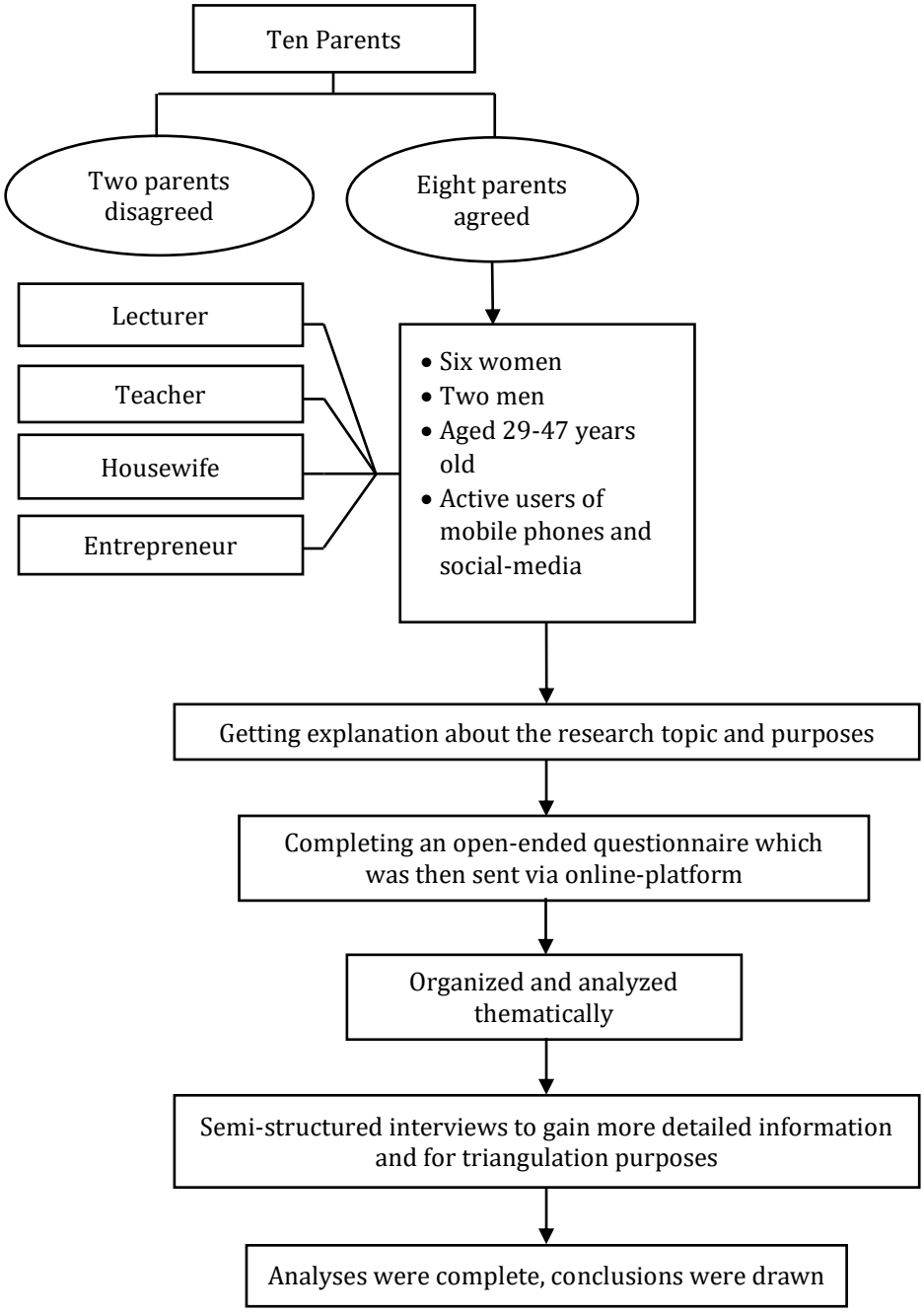

Fig. 1. Flow chart of study regarding mining the data.

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Results and Discussion

The results and discussion section elaborates the findings of the research based on the research questions and it is discussed in depth by comparing the findings with the previous studies and/or the existing theories. Each of the findings is supported by some evidence cited from the parents' responses to questionnaire and/or the interviews.

1. Parents' perceptions of coding learning for elementary school students

These findings investigate the parents' perceptions of coding curriculum which encouraged them to choose the school. All parents were confirmed to have positive perceptions of the coding school which were further explained as derived from several contributing factors. The first aspect that contributed to the parents' perceptions was their awareness of the importance of ICT skills, as reflected in the following responses:

> "*It's very important to learn ICT since right now almost all elements in life have used ICT in all activities. Children need to learn ICT as their skill in the future, so they don't only become the user, but they can be experts in ICT.*" (Parent 8, questionnaire).
>
> "*Everything will use technology. Various working choices will be available for them if they have ICT skills*." (Parent 4, questionnaire).

The parents' perception of the need for ICT skills pointed out general facts and their expectations. Job opportunities in computer and information technology are projected to increase year by year (Mason & Rich, 2019). At first, they only knew ICT in general terms, but then, through the school presentations and information from the school's social media, the parents recognized the contents of the learning process, such as coding, basic Microsoft Office, and designs. In more detail, one parent who was a lecturer pointed out the need to recognize algorithms for kids, which is one of the ICT skills.

> "*Coding trains the students to think algorithmically from an early age*." (Parent 1, questionnaire).

It implied that parents' perceptions on the need for ICT skills were also influenced by their background. Those concerning education might have a deeper understanding of what students learn through coding. Among several skills learned through coding are creating and debugging, controlling things, and using logic, and algorithms (Francisco *et al*., 2016) and it will contribute to their future, especially STEM-oriented career (Coravu *et al*., 2015). The parents' positive perceptions of the coding school were also a result of their trust in the institutions. More than half of the participants reported that they have got enough information about the school, including the curriculum and the learning activities through presentations from the school and the school's social media. They considered that the school provided complete content for their children, including targeted ICT skills, national curriculum content, and Islamic values. This

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school was managed under an Islamic foundation, so the parents' decision was also influenced by this factor. They also considered the teachers were qualified to handle the learning process. It implied that their decision was based on mindful consideration, especially when dealing with the curriculum contents and learning activities. The following statement represents parents' trust in the coding school.

> "*My child is learning coding and several topics about programming. I believe that this school can give knowledge and build a good personality for our children*." (Parent 5, questionnaire).

> "*My child has been taught coding in the first year, and it is the basic skill in ICT. It is very important nowadays and I trust this school*." (Parent 6, questionnaire).

The parents' perceptions of their children's interest in ICT also contributed to their positive perceptions of the coding school. The parents perceived that their children who were engaged with mobile phones and ICT needed to be guided to use those tools more productively.

> "*I don't want my child to play games only using gadgets. I want my child to learn from gadgets. My husband works as an IT engineer and my son has been close to gadgets since he was born. When he was 2 years old, he could access the internet after I turned it off. Compared to his linguistic and other skills, he performed the best in ICT*." (Parent 8, interview)

Since mobile phones and many digital media are all around, the parents thought that the best way to address this phenomenon was to let their children recognize the devices, and how they work, and encourage them to create their product. It is in line with one of the characteristics of ICT skills to initiate new ideas, to express themselves in diverse ways (Yu & Roque, 2018), one of which is by making their applications or games as one of the learning outputs in this school. From the elaborations above, it can be summarized that parents' positive perceptions of coding schools for kids before were influenced by several factors. Those factors are the parents' awareness of the necessity of ICT skills for the future, the trust of the educational institutions regarding the curriculum contents, teachers' qualifications, and learning activities, and the intention to facilitate and guide their children's interest in ICT.

2. Parents' perceptions of the student's progress

All parents perceived positively the children's progress during their enrolment in the coding school. They found that their children had been able to make simple games and simple designs using several applications such as Microsoft Word and Paint, rather than using mobile phones and PCs for passive activities. They also noticed that their children could use gadgets more wisely. It is very essential as one of the digital literacy skills in this 21st-century (Riyanti & Nurhasana, 2021). The following statements showed how the students' showed progress.

> "*I saw that my child now understands the priority in using gadgets*." (Parent 6, questionnaire).

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> "*Now my child doesn't only use gadgets to watch YouTube or play games. My child can do coding and picture editing*." (Parent 8, questionnaire).
>
> "*I think this school is good. Sometimes when my child does school projects, we are amazed that our child can do many things*." (Parent 5, questionnaire).

The student's progress must be supported by both the school and the parents. The school has arranged the curriculum based on the student's mental and intellectual development, so the students can easily follow each step. The school also provided various learning activities, both by using computers and without computers. This combination is important so that the students are still exposed to direct hands-on experience (Dong & Mertala, 2021) as well as developing their social skills, self-management, and academic skills as the outcomes of the coding (Popat & Starkey, 2019). Their extracurricular activities and school events also varied and attracted students' interest. ICT skills are not only presented in computer-based activities. The ICT skills of creating and debugging, controlling things, and using logic, and algorithms can also be implemented in many other activities which teach them problem-solving. It is supported by a previous study that coding helps students in problem-solving and cognitive abilities (Çiftci & Bildiren, 2020; Kalelioğlu, 2015). The combinations of various learning experiences result in a positive attitude of the children. The teachers' full attention to the students' progress also made the students feel safe in joining the learning process. Therefore, the parents saw the progress not only from the upgraded skills but also their attitude in joining the learning activities at school.

> "*Alhamdulillah my child feels really excited to learn and goes to school happily*." (Parent 4, questionnaire).
>
> "*I thank the teacher for always motivating my daughter. She was diagnosed with GBS when she was in the first year and it weakened her muscles, so she found it difficult to join several activities, such as rapid typing. It took a longer time for recovery. The homeroom teacher was so kind as to always motivate my daughter and tell me her progress*." (Parent 5, interview).

This progress was also the result of parents' contribution at home and daily practice outside the school environment. The parents reported that they provide time and facilities for the students to practice at home.

> "*I accompany my child in doing school projects*." (Parent 1, questionnaire).
>
> "*I give my child time to explore his skill and I also provide several facilities to help him improve his ICT skill*." (Parent 3, questionnaire).

It implies that students' progress and proficiency in ICT skills is determined by both the learning environment at school and at home. At school, the teachers need to give attention to the students and put concern on their progress and difficulties in learning since this school taught skills, not only knowledge. Therefore, teachers should always improve their skills and

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knowledge to optimally help the students (Uluyol & Şahin, 2016). The improvement of teachers' competence and professionalism would like to bring positive impact in the learning outcomes (Kerckaert *et al*., 2015; Santoso *et al*., 2023). At homes, parents invest their time and tools to facilitate their children. For this purpose, parents must pay more. It is also experienced by many parents around the world whose children learn ICT intensively. They considered it as an investment for the future as reported in the previous study (Rabah, 2015).

3. Parents and school's collaboration in developing ICT skills for children

The children's progress can't be separated from the role of the parents and the school's mutual collaborations to provide supporting learning environments and reinforcements. In an ICT school learning environment, parents tend to be the key feedback providers since their attitude was believed to influence their children's performance at school (Kong *et al*., 2019). Therefore, parents' support and involvement are considered as the determining factors in the success of ICT education at school. There were several collaborations between the parents and the school which were revealed from the data analysis. First, the school facilitated the parents with the information and current development of ICT through parents' seminars or digital contents through flyers or videos.

> "*The teacher always shares much information about ICT or about the school information through WhatsApp groups for parents*." (Parent 5, questionnaire).

As active users of ICT, all parents reported that they also used several practices in their daily activities. They also learned about ICT in their working environment as well as auto didactically through Google or social media. They also followed the school's social media to keep up to date with the school information and activities.

> "*I learn about the new trend in ICT on the internet (red-Google) and social media*" (Parent 3, questionnaire).
>
> "*Sometimes I learn in my office, if there is any training about ICT*."(Parent 5, questionnaire).

It implied that the parents were also digitally literate and that it made the school easier to communicate the children's learning programs as well as their progress. A previous study reported that parents' ICT use was associated with parenting efficacy, directly and indirectly. Parents who were engaged in online activities, such as email use and checking news online, frequently were likely to possess higher parenting efficacy. However, the use of blogs was negatively associated with their parenting efficacy (Jang *et al*., 2017). Therefore, it is suggested that parents could choose beneficial ICT activities which can support their literacy and help them with the children's needs. Second, the schools facilitated the learning materials in the form of videos so that the parents can accompany and learn together with their children at

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home. Since all students and teachers have more contact with technologies and the learning content, while parents are sort of practice (Brigas *et al*., 2016), schools need to provide assistance for parents to follow and supervise their children's progress. The learning videos enable parents to learn together or know what their children learn at school. It also provides flexibility for parents to accompany their children reviewing the learning materials.

> "*There are learning videos from the teacher, so I can learn together with my child*." (Parent 1, questionnaire).

Parents and children's interaction during practicing ICT skills, especially coding, has been reported to have positive impact on creating high-quality mutual interaction through question-answer, and responsiveness (Sheehan *et al*., 2019). Third, the schools and the parents implement the same rules for the use of mobile phones and PCs at home as the solution to tackle the possible threats. Both the parents and the school have the same mission to build the children's skills in ICT and to minimize the bad effects both in terms of health and social behavior (Dzulqornain *et al*., 2023). To prevent children from digital risks, precautions and interventions with the support of school-parent cooperation are very needed (Gür & Türel, 2022). They are aware of the threats.

> "*When parents can't accompany the children using ICT tools during the working hours, I am afraid that my child hasn't been totally responsible and tends to use it for fun, rather than making school projects or doing assignments*."(Parent 1, questionnaire).

> "*We as parents should give them understanding and limit the use of mobile phones since they can try many things in the digital world without any filter*."(Parent 5, questionnaire).

> "*Now children are smarter than parents in using technology, so I think the supervision will be more difficult*." (Parent 7, questionnaire)

To tackle the possible threat, the school has made the rules of using gadgets not more than 2 hours in a day. Both parents and teachers agreed with it. Besides, the teachers also always remind the students to use the gadget wisely and obey the parents at home. As the students were still young learners, they believe that repetition in reminding the rules will be effective.

> "*There is a regulation from school about the time limitation in using gadgets at home*." (Parent 6, questionnaire).

> "*They are always reminded to use IT wisely, along with the implementation of Islamic values, so they have good personality and be responsible in using ICT*." (Parent 8, questionnaire).

Completing the rules from school, the parents also implement some rules about the use of gadgets for their children. Among the rules are the following ones.

> "*All the devices belong to the parents, so the children should ask for permission to use it. There is also a time limitation. There is always supervision if they use an*

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internet connection." (Parent 5, questionnaire).

"*I choose to build good communication with my child, so they don't hesitate to share their experiences with us. And I also try to learn what my child learns at school, so I know his progress*." (Parent 8, questionnaire).

Through these mutual collaborations, the school together with the parents will eventually build the students competence as expected. They can take advantage of the opportunities of technology optimally by minimizing the risks by taking precaution in order to prevent their children from possible risks by informing, controlling and limiting their children (Gür & Türel, 2022). The last one is mutual communication and feedback between the teachers and the parents regarding the school programs and the students' progress. Formally the parents get the report of the students' progress per-3 months or after mid-semester tests and final tests in each semester. However, the teachers used to communicate with parents if their children found some difficulties in following the lesson or needed more practice at home.

"*There are mid-term and final semester reports. The teacher also communicates with parents if there are issues regarding the students' progress*." (Parent 4, questionnaire).

Some parents were also willing to give feedback for the school, in this case mostly dealing with the learning experiences. They conceived the school was open for any feedback and suggestion from parents. Constructive feedback from parents was well-responded by the school, although sometimes it took time.

"*I think the teachers should always improve their capability in making digital products and optimize social media for educating people. I also want the school to provide more programs to upgrade students' confidence, not only concerning ICT skills. The school management are very welcome, although the homeroom teachers sometimes need longer time to respond, ya maybe they have a lot of duties*." (Parent 6, interview).

The parents considered the openness of the teachers to communicate the students' progress and difficulties, as well as to receive feedback from parents as one of the prominent factors to maintain the mutual collaborations.

Conclusion

The parents have positive perceptions on coding school for elementary students in general. There are several factors which build the parents' perceptions. First, they have been aware of the importance of ICT skills for the children. Second, they trust the institution to handle coding curriculum which is integrated with national curriculum and Islamic values. Third, they perceive that their children are interested and talented in ICT, so the coding school will best facilitate their children's progress. The parents also have positive perceptions on their children's progress during their enrolment in the school. The children showed progress on ICT

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skills including coding, designs, and basic Microsoft office skills. They also perform a positive attitude toward the learning and the use of ICT tools. This study also pointed out the collaborations between the parents and the school in succeeding the learning process. The school assists the parent to guide the children learning at home by sharing information about ICT regularly and providing learning videos. They also apply the same rules regarding the use of mobile phones and PCs and commit to mutual communication. Apart from the prominent findings, this study only took a case at a local elementary school in Indonesian context. Further studies may involve ICT-based schools in higher levels of education to point out different characteristics, challenges, and participations from the parents.

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