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Instructional Strategy for critical thinking disposition: preparing prospective elementary teachers in the twenty-first century

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Abstract

Menerapkan pembelajaran aktif untuk mempromosikan disposisi berpikir kritis mahasiswa merupakan tujuan pendidikan saat ini. Namun, sangat jarang ditemukan penelitian yang mengeksplorasi disposisi berpikir kritis khususnya untuk **mahasiswa calon guru sains sekolah dasar**. Penelitian ini bertujuan untuk menyelidiki efek dari pembelajaran **collaborative inquiry pada disposisi berpikir kritis**. Desain kuasi eksperimen dengan kelompok kontrol pre-test/posttes digunakan. Sebanyak 149 mahasiswa program pendidikan guru sekolah dasar berpartisipasi dalam penelitian ini. Mereka dibagi menjadi dua kelompok yakni kelompok eksperimen yang memperoleh perlakuan dengan strategi pembelajaran *collaborative inquiry* (eksperimen) dan kelompok kontrol memperoleh perlakuan dengan strategi konvensional. Data disposisi berpikir kritis diperoleh melalui tes *critical thinking disposition inventory* dan dianalisis dengan *paired t test*. Temuan penelitian ini, menunjukkan bahwa siswa pada kelas eksperimen yang terpapar dengan pembelajaran kolaboratif inkuiri memperoleh skor disposisi berpikir kritis yang lebih tinggi dibandingkan dengan siswa pada kelas kontrol. Temuan dari penelitian ini mengungkapkan bahwa pembelajaran *collaborative inquiry* bisa menjadi strategi yang efektif untuk meningkatkan disposisi berpikir kritis.

Keywords: *Collaborative Inquiry Learning, Critical Thinking Disposition, Prospective Science Teachers*

1. Pendahuluan

Saat ini, kolaborasi dan berpikir kritis telah diakui sebagai keterampilan abad 21. Hampir diseluruh negara telah memasukan kedua keterampilan ini sebagai faktor penentu keberhasilan pendidikan (Ahonen & Kinnunen, 2015; van Laar et al., 2020). Di Indonesia, kurikulum berbasis kompetensi telah lama diperkenalkan oleh Kementerian Pendidikan dan Kebudayaan, dengan penekanan pada pembentukan karakter dan sikap ilmiah seperti pemikiran logis, kreatif dan inovatif. Namun, fakta menunjukkan bahwa pada lulusan perguruan tinggi, kolaborasi dan pemikiran kritis ditemukan sangat terbatas, termasuk siswa calon guru yang dipersiapkan untuk mengajar dimasa depan (Brevik et al., 2018; Irwanto, 2018; Straková & Cimermanová, 2018). Pada saat yang sama, sikap dan keterampilan ini diperlukan dalam dunia kerja.

Dikotomi yang bermasalah ini menghadirkan kebutuhan untuk lebih memahami bagaimana kolaborasi dan berpikir kritis diajarkan terutama kepada calon guru sekolah dasar yang siap untuk mengajar siswa mereka di masa depan. Facione (2000), merekomendasikan bahwa pemikiran kritis dapat ditingkatkan melalui pengembangan disposisi berpikir kritis. Siswa yang memiliki kesadaran dan sikap untuk berpikir kritis berpeluang untuk mengasah keterampilan berpikir kritis.

Banyak studi telah berfokus pada upaya untuk meningkatkan keterampilan berpikir kritis melalui penerapan strategi pembelajaran seperti penelitian Ahmad

(2019) yang menerapkan pendekatan Problem-Based Learning untuk mengetahui disposisi berpikir kritis siswa (Ahmad et al., 2019). Penelitian lainnya Arzal (2017) menggunakan pendekatan inquiry-based learning untuk disposisi berpikir kritis pada siswa kelas matematika (Arzal, 2017). Dehghanzadeh & Fateme Jafaraghaie (2018) membandingkan pengaruh pembelajaran tradisional dengan pendekatan flipped classroom pada keterampilan disposisi berpikir kritis untuk siswa keperawatan.

(misalnya: Erdogan, 2019; Mahanal et al., 2019; Saputra et al., 2019; Yasin et al., 2019).

Namun, masih sangat terbatas studi yang berfokus pada upaya untuk meningkatkan disposisi berpikir kritis dengan pendekatan pembelajaran kolaboratif inkuiri. To the best of our knowledge, belum ada studi disposisi berpikir kritis yang dilakukan untuk calon guru sekolah dasar (

Penelitian menunjukkan bahwa ada hubungan yang signifikan antara kegiatan pembelajaran bagi calon guru dan kegiatan mengajar di sekolah (de Vries et al., 2014; Desimone et al., 2002; Stokking et al., 2003). Siswa calon guru yang terlibat dalam kegiatan pembelajaran aktif akan menginspirasi mereka untuk menerapkannya di sekolah (Agyei & Voogt, 2014; Desimone et al., 2002; Schwarz et al., 2009). Ini berarti guru perlu menanamkan sikap positif terhadap pemikiran kritis. Mereka harus terlebih dahulu menyadari disposisi berpikir kritis mereka dan bertanggung jawab terhadap pekerjaan serta keterampilan berpikir kritis siswa mereka. Guru yang tidak memiliki disposisi berpikir kritis, dengan sendirinya tidak memiliki kemampuan mengajarkan disposisi berpikir kritis kepada siswa mereka (Mohamad et al., 2015). Pernyataan ini didukung oleh (Abrami et al., 2008; Facione, 2000; Unlu, 2018) yang mengemukakan bahwa cara terbaik untuk meningkatkan keterampilan dan disposisi berpikir kritis adalah dengan menerapkannya secara eksplisit melalui aktivitas akademik seperti pelatihan dan pengembangan fakultas.

Hal ini dianggap perlu untuk diselidiki, mengingat kelangkaan literatur tentang kecenderungan berpikir kritis calon guru sekolah dasar. Dengan demikian, untuk mengisi kekosongan dalam literatur, **penelitian ini bertujuan untuk mengetahui disposisi berpikir kritis calon guru sekolah dasar dengan menerapkan strategi pembelajaran kolaboratif inkuiri.**

Pembelajaran kolaboratif tidak hanya belajar dan bekerja dalam kelompok dengan instruksi guru tetapi proses dimana dua atau lebih orang berinteraksi untuk mengaktifkan kognisi mereka (Dillenbourg, 1999). Dalam berkolaborasi, siswa harus terlibat bersama, mengenali perbedaan pengetahuan, menyatukan persepsi, dan mencari solusi. Keberhasilan individu dalam kolaborasi terletak pada aktivitas dan usaha intelektual bersama (Laal & Laal, 2012; Lou & Kim MacGregor, 2004). Banyak peneliti telah berfokus pada pembelajaran kolaboratif. Hal ini dipengaruhi oleh karakteristik pembelajaran kolaboratif yang menekankan pada interaksi sosial, keterlibatan intelektual, dan tanggung jawab bersama (Shelton & Rawlings, 1992). Istilah kolaboratif inkuiri adalah sub-kategori dari pembelajaran kolaboratif dan inkuiri. Kata inkuiri berasal dari kata to inquiry yang artinya keterlibatan dalam mengajukan pertanyaan, mencari informasi, dan melakukan investigasi (Lott, 2011). Inkuiri adalah pendekatan kolaboratif untuk memecahkan masalah secara reflektif dan interaktif dimana individu membangun makna dan bersama-sama mengkonfirmasi pemahaman (Garrison, 2016). Menggabungkan pembelajaran kolaboratif dengan pembelajaran inkuiri dapat meningkatkan kinerja yang mengarah pada pengembangan pengetahuan baru (Okada & Simon, 1997; Springer et al., 1999b; van Boxtel et al.,

2000). Ada hubungan yang sangat penting antara pembelajaran kolaboratif inkuiri dan disposisi berpikir kritis. Keduanya didasarkan pada kesediaan siswa untuk bertanggung jawab dan memiliki kemampuan untuk membangun makna serta memvalidasi informasi. Disposisi berpikir kritis merupakan semangat jiwa dan motivasi diri untuk aktif dan secara sistematis terlibat dalam verifikasi masalah, memahami masalah, mencari dan mempertimbangkan bukti, serta evaluasi. Dalam konteks pembelajaran kata disposisi mengarah pada pengaturan diri dan keterlibatan aktif dalam pencarian kebenaran sementara istilah berpikir kritis berkontribusi pada kemampuan siswa untuk memeriksa, mengevaluasi, mengkritik, mempromosikan konsep berdasarkan fakta yang valid. Disposisi berpikir kritis sangat diperlukan untuk mengantarkan mahasiswa calon guru sekolah dasar untuk berpikir kritis. Ini tidak hanya untuk kebutuhan pribadi mereka tetapi juga untuk masa depan generasi mereka. Hal ini, dapat dicapai jika mereka dilatih untuk terlibat bersama dalam merencanakan, merancang dan melakukan penyelidikan.

Penelitian ini bertujuan untuk menyelidiki pengaruh *collaborative inquiry learning* terhadap disposisi berpikir kritis mahasiswa calon guru sains sekolah dasar. Adapun pertanyaan penelitian ini adalah

RQ1: Apakah ada perbedaan yang signifikan antara skor pre-test dan post test kelompok eksperimen dalam hal disposisi berpikir kritis?

RQ2: Apakah ada perbedaan yang signifikan antara skor pre-test dan post test kelompok kontrol dalam hal disposisi berpikir kritis?

RQ3: Apakah ada perbedaan yang signifikan antara skor post test kelompok eksperimen dan kelompok kontrol dalam hal disposisi berpikir kritis?

2. Literature Review

2.1 Berpikir Kritis (CT) dan Disposisi Berpikir Kritis (CTD)

Ada beberapa pandangan yang berbeda terkait dengan definisi berpikir kritis. Perbedaan ini, membutuhkan pertimbangan yang kritis untuk menarik kesimpulan yang tepat. Berpikir kritis menurut Kurfiss, (1988) adalah respon rasional terhadap pertanyaan yang tidak dapat dijawab secara pasti. Kurfiss, (1988) menegaskan bahwa dalam berpikir kritis investigasi menjadi fokus utama dalam mengeksplorasi situasi, fenomena, pertanyaan atau masalah untuk sampai pada hipotesis atau kesimpulan secara masuk akal. Paul (1982), mengemukakan bahwa dalam berpikir kritis kecerdasan intelektual dan kerendahan hati merupakan dasar untuk memahami dunia yang berbeda secara holistik. Menurut Paul, proses berpikir kritis diawali dengan seseorang melihat berbagai hal dari perspektif yang berbeda, dan menemukan solusi berdasarkan kesepakatan bersama. Berpikir kritis adalah proses menganalisis dan menilai pemikiran dengan maksud untuk meningkatkannya. Kunci untuk sisi kreatif dari berpikir kritis adalah restrukturisasi berpikir sebagai hasil dari menganalisa dan menilai secara efektif (Paul & Elder, 2005).

Ennis (2014) mendefinisikan pemikiran kritis sebagai pemikiran reflektif yang masuk akal yang terfokus pada memutuskan apa yang harus di percaya atau lakukan. Pemikiran reflektif berarti secara sadar dan sukarela mempertimbangkan segala hal secara aktif, gigih dan hati-hati sebelum mengambil keputusan dan membuat kesimpulan. Proses pengambilan keputusan membutuhkan keterampilan mengamati, menyimpulkan, mengeneralisasikan, membuat penalaran dan melakukan evaluasi sedangkan untuk menarik kesimpulan benar dan masuk akal di butuhkan bukti-bukti

yang relevan berdasarkan pertimbangan secara aktif, tekun dan hati-hati. Siegel menguatkan pandangan Paul dan Ennis bahwa dalam berpikir kritis tidak hanya keterampilan yang di butuhkan tetapi juga dibutuhkan alasan dan kekuatan alasan untuk membenarkan keyakinan, klaim dan tindakan (Bellous, 1991)

. Baik Paul, Ennis maupun Siegel, ketiganya memiliki konsep yang sama terkait dengan proses berpikir kritis diantaranya: 1) dimulai dengan proses penalaran yang melibatkan kecerdasan intelektual dan kerendahan hati 2) pemecahan masalah secara holistik dan interaktif; 3) pengambilan keputusan berdasarkan pada bukti dan pertimbangan nilai. Dengan berlandaskan definisi tersebut para ahli lainnya seperti Ahrari, Samah, Hassan, Wahat, & Zaremohzzabieh (2016), mengemukakan bahwa seseorang dapat dikatakan sebagai pemikir kritis jika ia mampu berpikir dan mengeksplorasi ide-ide baru, mengambil keputusan berdasarkan bukti-bukti, bertindak secara dinamis, produktif, sensitif dan kreatif. Pemikir kritis mampu mengenali kekuatan dan kelemahan dirinya, bersedia memberikan pandangan, berpikiran terbuka, mampu membedakan yang baik atau yang buruk, mampu mengeksplorasi, jujur dan percaya diri serta fleksibel. Sikap waspada dan skeptis terhadap pernyataan, komentar dan argumen yang tidak dibuktikan kebenarannya juga merupakan bagian dari berpikir kritis.

Berpikir kritis sangat dibutuhkan di dunia kerja sehingga menarik banyak orang untuk melakukan penelitian tentang berpikir kritis. Namun untuk mencapai pada pemikir kritis di perlukan disposisi berpikir kritis (Ennis, 1996; Zooler, et al,2000). Menurut Ennis (1985), disposisi berpikir kritis merupakan motivasi atau semangat untuk berpikir kritis. Kata disposisi memiliki makna kecenderungan untuk melakukan sesuatu dan mengingat kondisi tertentu (Ennis, 1996). Disposisi digunakan oleh pemikir kritis untuk menerapkan kemampuan berpikir kritis pada pemikiran sendiri dan pemikiran orang lain. Disposisi sangat dibutuhkan dalam pembelajaran di kelas karena merupakan media penghubung kemampuan berpikir kritis. Ben-Chaim et al., (2000), mengemukakan bahwa disposisi berpikir kritis dapat memberikan pengaruh dalam pendidikan. Dengan demikian, pendidik tidak hanya mengasah keterampilan kognitif, tetapi juga memberikan penguatan pada cara berpikir kritis.

Penguatan diberikan melalui motivasi, kecenderungan dan dorongan untuk terlibat dalam pemikiran kritis dengan berfokus pada masalah penting, membuat keputusan dan menyelesaikan masalah. Aspek-aspek tersebut merupakan bagian penting dari disposisi berpikir kritis (Facione et al, 1995, (Facione et al., 1996)). Selain aspek-aspek tersebut Ennis (1999), juga mengemukakan bahwa kemampuan mengajukan pertanyaan, membangun konsep yang kompleks, melakukan klarifikasi, memahami konsep juga merupakan disposisi berpikir kritis. Ennis (1999), memperjelas pendapat Perkins, Jay dan Tisman (1993) yang menawarkan tiga komponen dalam disposisi berpikir kritis yakni kecenderungan, sensitivitas dan kemampuan. Menurut Ennis (1999) sensitivitas dan kemampuan kurang dibutuhkan dalam disposisi berpikir kritis. Ennis kemudian menawarkan sistem penilaian yang sederhana yang telah dikembangkan oleh beberapa ahli (misal:Perkins, Jay & Tisman, 1993; Facione & Facione, 1992). Menurut Ennis (1996), pemikir ideal cenderung untuk peduli bahwa mereka dapat melakukan sesuatu dengan benar dan dapat dipertanggungjawabkan, jujur dan jelas, peduli terhadap martabat dan nilai setiap individu. Disposisi berpikir kritis sangat penting diajarkan di dunia pendidikan. Terutama di pendidikan tinggi. Lulusan perguruan tinggi harus memiliki kemampuan berpikir kritis yang nantinya digunakan di dunia kerja. Mahasiswa calon guru sangat dianjurkan untuk memiliki keterampilan berpikir kritis termasuk disposisi berpikir

kritis, karena pengetahuan dan keterampilan berpikir kritis yang diperoleh akan ditularkan kepada siswa. Pentingnya disposisi berpikir kritis ini, menarik beberapa peneliti untuk melakukan penelitian tentang disposisi berpikir kritis guru dan calon guru. Penelitian yang dilakukan oleh (Demirhan & Köklükaya, 2014), menunjukkan bahwa calon guru sains memiliki kemampuan berpikir kritis pada taraf menengah dan rendah. Hasil penelitian ini merekomendasikan bahwa perlu adanya model, strategi, pendekatan dan metode untuk meningkatkan keterampilan berpikir kritis calon guru sains. Hasil penelitian ini sejalan dengan penelitian sebelumnya yang dilakukan oleh (Kezer & Turker, 2012), terkait dengan disposisi berpikir kritis calon guru sains di Turki. Penelitian yang dilakukan oleh (Arsal, 2017), tentang pengaruh pembelajaran *inquiry* terhadap disposisi berpikir kritis calon guru dengan metode *quasi* eksperimen menunjukkan bahwa tidak ada pengaruh yang signifikan antara pembelajaran berbasis *inquiry* dengan disposisi berpikir kritis calon guru, meskipun terjadi peningkatan disposisi berpikir kritis. Hasil ini bertentangan dengan beberapa penelitian sebelumnya seperti (Kwan & Wong, 2015) dan (Zhou et al., 2010) serta Thaiposri & Wannapiron, (2015) yang menemukan bahwa pembelajaran berbasis *inquiry* secara positif mempengaruhi disposisi berpikir kritis calon guru.

2.2 Collaborative Inquiry Learning

Pembelajaran kolaboratif tidak hanya belajar dan bekerja dalam kelompok dengan instruksi guru tetapi proses dimana dua atau lebih orang berinteraksi untuk mengaktifkan kognisi mereka (Dillenbourg, 1999). Dalam berkolaborasi, siswa harus terlibat bersama, mengenali perbedaan pengetahuan, menyatukan persepsi, dan mencari solusi. Keberhasilan individu dalam kolaborasi terletak pada aktivitas dan usaha intelektual bersama (Laal & Laal, 2012; Lou & Kim MacGregor, 2004). Di era pembelajaran kolaboratif saat ini yang ditemukan lebih menonjol, banyak peneliti pedagogis yang berfokus pada pembelajaran kolaboratif. Hal ini dipengaruhi oleh karakteristik pembelajaran kolaboratif yang menekankan pada interaksi sosial, keterlibatan intelektual, dan tanggung jawab bersama (Shelton & Rawlings, 1992) - seiring dengan berkembangnya istilah penelitian pendidikan kolaboratif, kemudian dipadukan dengan beberapa metode pembelajaran, misalnya kolaboratif. pembelajaran inkuiri. Istilah inkuiri kolaboratif adalah sub-kategori dari pembelajaran kolaboratif dan inkuiri. Kata inkuiri berasal dari kata inkuiri yang artinya keterlibatan dalam mengajukan pertanyaan, mencari informasi, dan melakukan investigasi (Lott, 2011). Penyelidikan adalah pendekatan kolaboratif untuk memecahkan masalah dengan cara reflektif dan interaktif di mana individu membangun makna dan bersama-sama mengkonfirmasi pemahaman (Garrison, 2016).

Menggabungkan pembelajaran kolaboratif dengan pembelajaran inkuiri dapat meningkatkan kinerja yang mengarah pada pengembangan pengetahuan baru (misalnya, (Okada & Simon, 1997; Springer et al., 1999b; van Boxtel et al., 2000). Ketika siswa berkolaborasi, mereka dapat bertukar pikiran, bertanya, memberikan penjelasan, dan bernegosiasi. Dalam melaksanakan pembelajaran inkuiri kolaboratif, pembelajaran memerlukan persiapan dari peserta didik. Peran guru seaktif peran siswa, dan guru harus aktif dalam memenuhi kebutuhan siswa. Selama inkuiri kolaboratif Kegiatan seperti perencanaan pembelajaran, menciptakan iklim kolaborasi, dorongan, dan motivasi adalah tugas utama peserta didik (Urhahne et al., 2010) Peserta didik yang merancang pembelajaran sebelum mengajar dapat berkontribusi pada pemahaman siswa (van Uum et al., 2017). Peserta didik harus memastikan bahwa lingkungan

belajar termasuk media dan sumber belajar sudah sesuai dengan kegiatan inkuiri Peserta didik perlu menguasai semua peralatan yang digunakan, meliputi perangkat, bahan ajar, dan langkah-langkah pembelajaran.

2.3 Pengembangan Hipotesis

Research Methodology

Research Design

Kuasi eksperimen dengan pre-test/post-test *control group design* digunakan dalam penelitian ini. Empat kelas paralel diberikan intervensi selama 12 minggu pada bulan Agustus hingga Nopember 2019. Dua kelas paralel sebagai kelompok eksperimen yang diajarkan dengan pembelajaran kolaboratif inkuiri. Sementara dua kelas lainnya sebagai kelompok kontrol yang diajarkan dengan inkuiri konvensional. Pembelajaran kolaboratif inkuiri dan konvensional sebagai variabel independen sedangkan disposisi berpikir kritis sebagai variabel dependen. California Critical Thinking Disposition (CCTD) (Facione et al, 1999) digunakan untuk menilai disposisi berpikir kritis mahasiswa calon guru sains Sekolah Dasar sebelum dan setelah intervensi.

Sample / Participants / Group

Penelitian ini melibatkan 149 mahasiswa program Pendidikan Guru Sekolah Dasar Universitas Khairun Ternate Indonesia. Mereka adalah mahasiswa tahun pertama yang mengikuti kuliah sains dasar. Mereka dibagi menjadi dua kelompok yakni kelompok eksperimen (N=74) dan kelompok kontrol (N=75). Pembagian ini didasarkan pada data....yang diperoleh melalui form identitas pribadi dan skor pre-test disposisi berpikir kritis. Hasil uji t sampel independen data pre-test menunjukkan bahwa dua kelompok ini memiliki disposisi berpikir kritis yang setara ($t(149) = -0,528; p > 0,05$).

Pengembangan Instrument

Dalam pengukuran disposisi berpikir kritis digunakan instrumen penilaian berupa angket dengan skala bertingkat. Instrumen tersebut disusun dalam bentuk pernyataan dengan jumlah item sebanyak 49. Pernyataan Angket bersumber dari tujuh kebiasaan berpikir yang dikemukakan oleh Facione yakni pencarian kebenaran, pikiran terbuka, analitik, sistematis keingintahuan, kepercayaan diri dan kedewasaan. Instrumen tersebut disusun menggunakan skala likert. Instrumen ini dikembangkan dengan mengadaptasi dari instrumen yang telah dikembangkan oleh Sosu (2013) dan Shin, Park & Kim, (2015). Kedua instrumen ini dijadikan rujukan karena pengembangan instrumennya didasarkan pada indikator disposisi berpikir kritis yang dikembangkan oleh beberapa ahli seperti Halpern (1998); Ennis (1996); Facione & Facione (1994).

Tabel 1. Instrumen Penelitian

Procedures

Penelitian ini diawali dengan kegiatan *focus group discussion* (FGD) antar dosen pengampu mata kuliah, peneliti dan observer. FGD dilakukan untuk memastikan bahwa semua perangkat-perangkat, alat dan media serta sarana pendukung telah disiapkan. Penentuan waktu pelaksanaan penelitian dan pembagian tugas tim peneliti juga disepakati pada kegiatan FGD.

Setelah melakukan FGD, peneliti kemudian menghubungi mahasiswa dan melakukan tindakan awal yakni membuat kesepakatan melalui pengisian formulir kontrak belajar, pengisian instrumen data diri yang mencakup nama, tempat tanggal lahir, jenis kelamin, asal dan sebagainya. Selanjutnya, peserta dari kelompok eksperimen dan kelompok kontrol diberi pelatihan singkat tentang prosedur dan langkah-langkah pembelajaran kolaboratif inkuiri. Peneliti juga memberi penjelasan tentang prinsip-prinsip kerja sama tim.

Proses penelitian ditetapkan pada semester ganjil sebanyak 16 kali pertemuan, mulai dari tahap pre-test, tahap treatment hingga tahap post-test. Kegiatan pre-test dilakukan minggu pertama dengan cara membagikan angket disposisi berpikir kritis kepada mahasiswa satu minggu sebelum dilakukan perlakuan. Selanjutnya, tahap treatment dilakukan pada kelompok eksperimen dan kelompok kontrol. Pada pertemuan pertama guru memberikan penguatan langkah-langkah metode ilmiah untuk memperkuat keterampilan penyelidikan. Sesi perkuliahan selama 14 minggu dengan total 340 jam pelajaran dilaksanakan secara tatap muka, non tatap muka, dan penyelidikan lapangan atau laboratorium. Aktivitas pembelajaran kolaboratif inkuiri didesain dengan melibatkan mahasiswa untuk mempelajari konsep, merancang penyelidikan, melakukan penyelidikan di laboratorium maupun di lingkungan terbuka dan membuat laporan secara berkelompok. Setiap anggota kelompok diberikan waktu untuk menyiapkan setiap unit kegiatan penyelidikan dengan mempelajari informasi sebelum perkuliahan dimulai pada pertemuan berikutnya. Pengetahuan konseptual awal setiap anggota kelompok digunakan sebagai bahan diskusi kelompok dalam merancang dan melakukan penyelidikan. Peneliti merancang intervensi dan menyediakan instruktur dengan semua bahan yang diperlukan.

Dalam penelitian ini, Langkah-langkah pembelajaran *collaborative inquiry* diadaptasi dari beberapa sumber seperti Cash, Dekonick, & Ahmed-Kristenen, 2017, Khine & Saleh (2010) dan Padaste et al (2015). Ada lima fase pembelajaran *collaborative inquiry* yakni fase orientasi, konseptualisasi, investigasi, kesimpulan dan diskusi.

Fase orientasi merupakan proses untuk mengidentifikasi dan mendorong rasa ingin tahu siswa tentang topik yang diajarkan. Pada fase ini instruktur membagi siswa dalam kelompok-kelompok kecil secara heterogen, memberikan tugas penyelidikan, menyampaikan instruksi. Siswa bekerja secara berkelompok, berbagi tugas, melakukan *brainstorming*, menentukan masalah untuk diselesaikan serta menetapkan tujuan bersama.

Selanjutnya, pada fase konseptualisasi siswa berdiskusi dalam kelompok untuk merumuskan masalah atau pertanyaan, merumuskan hipotesis berdasarkan teori. Proses ini dilakukan dengan berbagi pemahaman bersama tentang topik melalui komunikasi dan interaksi sosial. Anggota tim dari masing-masing kelompok menguraikan konteks penyelidikan dan gagasan mereka untuk memperbaiki serta mengembangkan rencana disain. Proses ini disebut fase investigasi yang secara

ringkas diawali dengan kegiatan eksplorasi, dilanjutkan dengan eksperimen dan diakhiri dengan interpretasi.

Setelah melalui fase investigasi, fase berikutnya adalah proses untuk membuat kesimpulan berdasarkan data serta membandingkan kesimpulan berdasarkan data dengan hipotesis atau pertanyaan penelitian. Hasil temuan-temuan tersebut disajikan dalam bentuk laporan yang akan didiskusikan kepada kelompok lainnya pada fase diskusi. Adapun instruksi pembelajaran collaborative inquiry digambarkan dalam tabel berikut ini:

Tabel 1.1. Langkah-langkah pembelajaran sains dasar PGSD menggunakan Strategi Pembelajaran kolaboratif inkuiri

Tahap	Kegiatan Pembelajaran	Aktifitas pebelajar
Orientasi	<ol style="list-style-type: none"> 1. pembelajar menyampaikan tujuan pembelajaran 2. Menyediakan ruang kerja dan Fasilitas Belajar 3. Membagi pebelajar dalam kelompok keCoIL 3-4 orang (kelompok heterogen) 4. pembelajar membagikan topik/masalah/pertanyaan untuk didiskusikan 5. Menyampaikan instruksi keterampilan menyelidiki dan keterampilan ilmiah 	<ol style="list-style-type: none"> 1. Mengenali tujuan utama dari pembelajaran 2. Mengambil posisi secara berkelompok 3. Mendiskusikan tugas yang dibagikan 4. Diskusikan semua topik/pertanyaan/masalah 5. Identifikasi topik melalui <i>brainstorming</i> 6. Menentukan skala prioritas 7. Mengenali tantangan tugas 8. Menetapkan tujuan bersama
Konseptualisasi	<ol style="list-style-type: none"> 1. Membagikan bahan ajar 2. Melakukan pendampingan dan pembimbingan 3. Memberikan dukungan motivasi dan co-eksistensi 	<ol style="list-style-type: none"> 1. Berbagi pemahaman bersama tentang topik melalui komunikasi 2. Pelajari konten yang dipilih 3. Diskusikan semua hal tentang konten 4. Kumpulkan perspektif pendapat yang berbeda 5. Urutkan setiap pendapat dalam bentuk tabel 6. Buat persetujuan melalui peta konsep 7. Merumuskan pertanyaan atau hipotesis 8. Pilih dan kembangkan rencana desain 9. Identifikasi sumber daya yang dibutuhkan 10. Pertimbangkan informasi awal

		untuk memvalidasi rencana desain
Investigasi	<ol style="list-style-type: none"> 1. Minta pebelajar untuk mengorganisir ide-ide secara alami 2. Memastikan pebelajar saling berbagi 3. Memberikan dukungan motivasi 	<ol style="list-style-type: none"> 1. Menguraikan informasi dan gagasan untuk memperbaiki dan mengembangkan rencana desain 2. Menetapkan langkah-langkah eksplorasi dan eksperimen 3. Mengidentifikasi dan menetapkan tugas berdasarkan sumber daya dan keahlian 4. Berkolaborasi dengan instruktur untuk memperoleh gagasan 5. Melakukan eksplorasi dan eksperimen berdasarkan tugas dan langkah-langkah yang ditetapkan 6. Mengumpulkan bukti: menentukan jenis data
Diskusi & Kesimpulan	Membimbing pebelajar untuk membuat kesimpulan	<ol style="list-style-type: none"> 1. Kesepakatan tim untuk membuat kesimpulan berdasarkan data 2. Membandingkan kesimpulan dengan hipotesis yang dibuat

Data Analysis

Analisis Data

Uji normalitas menggunakan Kolmogorov-Smirnov dilakukan pertama kali dalam analisis data untuk menguji distribusi normal dari data. Pengujian dilanjutkan dengan uji homogenitas ragam menggunakan Levene untuk menguji homogenitas ragam antar kelompok. Berdasarkan hasil uji normalitas dan uji homogenitas ragam akan ditentukan apakah uji parametrik dapat digunakan atau tidak. Pengujian secara parametrik menggunakan paired t-test untuk membandingkan pre test dan post test, kemudian independent t-test untuk membandingkan antar kelompok.

Hasil Analisis

Tabel 1. Hasil Uji Normalitas dengan Kolmogorov-Smirnov

Komponen			K-S	P
Anllicity	Pre-test	Eksperimen	0.095	0.094
		Kontrol	0.097	0.079
	Post-test	Eksperimen	0.085	0.200
		Kontrol	0.094	0.095
CT-Self Confidence	Pre-test	Eksperimen	0.100	0.064
		Kontrol	0.085	0.200
	Post-test	Eksperimen	0.091	0.200

		Kontrol	0.088	0.200
Mature Judgement	Pre-test	Eksperimen	0.098	0.076
		Kontrol	0.090	0.200
	Post-test	Eksperimen	0.096	0.090
		Kontrol	0.093	0.171
Inquisitiveness	Pre-test	Eksperimen	0.091	0.200
		Kontrol	0.094	0.098
	Post-test	Eksperimen	0.096	0.089
		Kontrol	0.081	0.200
Open-mindedness	Pre-test	Eksperimen	0.094	0.176
		Kontrol	0.097	0.075
	Post-test	Eksperimen	0.091	0.200
		Kontrol	0.091	0.199
Systematicity	Pre-test	Eksperimen	0.097	0.079
		Kontrol	0.083	0.200
	Post-test	Eksperimen	0.100	0.065
		Kontrol	0.100	0.061
Truth-seeking	Pre-test	Eksperimen	0.087	0.200
		Kontrol	0.092	0.184
	Post-test	Eksperimen	0.083	0.200
		Kontrol	0.091	0.198
Total	Pre-test	Eksperimen	0.094	0.168
		Kontrol	0.094	0.168
	Post-test	Eksperimen	0.090	0.200
		Kontrol	0.090	0.200

Hasil pengujian normalitas dengan Kolmogorov-Smirnov pada Tabel 1 menunjukkan data yang digunakan berdistribusi normal ($p > 0.05$) terhadap seluruh komponen disposisi berpikir kritis pada masing-masing kelompok yang diuji, baik pada nilai pre-test maupun nilai post-test. Tabel 2 menyajikan hasil tes Levene pada skor perolehan skor pre-test dan post test yang diperoleh oleh kelompok eksperimen dan control dari CTD.

Tabel 2. Hasil Uji Homogenitas Ragam dengan Levene

Komponen		F	df1	df2	P
Anliticality	Pre-test	0.001	1	147	0.973
	Post-test	3.522	1	147	0.063
CT-Self Confidence	Pre-test	1.035	1	147	0.311
	Post-test	0.385	1	147	0.536
Mature Judgement	Pre-test	0.066	1	147	0.797
	Post-test	0.354	1	147	0.553
Inquisitiveness	Pre-test	0.156	1	147	0.693
	Post-test	0.007	1	147	0.932
Open-mindedness	Pre-test	0.166	1	147	0.684

	Post-test	3.463	1	147	0.065
Systematicity	Pre-test	2.640	1	147	0.106
	Post-test	1.349	1	147	0.247
Truth-seeking	Pre-test	1.778	1	147	0.184
	Post-test	3.491	1	147	0.064
Total	Pre-test	2.766	1	147	0.098
	Post-test	3.492	1	147	0.064

Seperti yang ditunjukkan pada table 2, varians dalam skor pre-test dan post-test dari kelompok eksperimen dan control dari total komponen CTD menunjukkan data homogen. Secara umum, hasil goodness of fit Kolmogorof-Smirnov dan Uji Levene mengungkapkan bahwa uji parametric dapat digunakan untuk menganalisis data yang diperoleh dari penelitian. Tabel 3. Menyajikan hasil uji-t sampel independent pada skor pra-test dari kelompok eksperimen dan control dari CTD.

Tabel 3. Hasil Independent t-test terhadap Nilai Pre-test antara Kelompok Eksperimen dan Kelompok Kontrol

Komponen		N	M	SD	t	df	P
Anliticity	Eksperimen	74	2.498	0.377	1.386	147	0.168
	Kontrol	75	2.413	0.366			
CT-Self Confidence	Eksperimen	74	2.703	0.370	0.680	147	0.497
	Kontrol	75	2.658	0.431			
Mature Judgement	Eksperimen	74	2.270	0.355	0.472	147	0.638
	Kontrol	75	2.242	0.373			
Inquisitiveness	Eksperimen	74	2.516	0.406	-0.225	147	0.822
	Kontrol	75	2.531	0.428			
Open-mindedness	Eksperimen	74	2.541	0.441	-1.039	147	0.300
	Kontrol	75	2.618	0.466			
Systematicity	Eksperimen	74	2.523	0.363	-1.572	147	0.118
	Kontrol	75	2.627	0.440			
Truth-seeking	Eksperimen	74	2.511	0.455	-1.525	147	0.129
	Kontrol	75	2.617	0.393			
Total	Eksperimen	74	2.509	0.214	-0.528	147	0.598
	Kontrol	75	2.529	0.241			

* $p < .05$

Hasil perbandingan nilai pre-test antara kelompok eksperimen dan kelompok kontrol pada Tabel 3 menunjukkan tidak adanya perbedaan signifikan terhadap seluruh komponen yang diuji.

Hasil perbandingan nilai pre-test dan post-test pada kelompok eksperimen pada Tabel 4 menunjukkan adanya perbedaan signifikan terhadap seluruh komponen yang diuji.

Tabel 4. Hasil Paired t-test terhadap Nilai Pre-test dan Post-test pada Kelompok Eksperimen

Komponen		N	M	SD	T	df	P
Anlitivity	Pre-test	74	2.498	0.377	-14.105	73	0.000*
	Post-test	74	3.329	0.437			
CT-Self Confidence	Pre-test	74	2.703	0.370	-10.504	73	0.000*
	Post-test	74	3.387	0.450			
Mature Judgement	Pre-test	74	2.270	0.355	-18.723	73	0.000*
	Post-test	74	3.421	0.439			
Inquisitiveness	Pre-test	74	2.516	0.406	-13.880	73	0.000*
	Post-test	74	3.547	0.450			
Open-mindedness	Pre-test	74	2.541	0.441	-14.847	73	0.000*
	Post-test	74	3.504	0.442			
Systematicity	Pre-test	74	2.527	0.367	-13.798	73	0.000*
	Post-test	74	3.493	0.492			
Truth-seeking	Pre-test	74	2.511	0.455	-14.230	73	0.000*
	Post-test	74	3.509	0.461			
Total	Pre-test	74	2.509	0.214	-21.146	73	0.000*
	Post-test	74	3.456	0.338			

* p < .05

Tabel 5. Hasil Paired t-test terhadap Nilai Pre-test dan Post-test pada Kelompok Kontrol

Komponen		N	M	SD	t	df	P
Anlitivity	Pre-test	75	2.413	0.366	-14.668	74	0.000
	Post-test	75	3.151	0.355			
CT-Self Confidence	Pre-test	75	2.658	0.431	-9.077	74	0.000
	Post-test	75	3.124	0.426			
Mature Judgement	Pre-test	75	2.242	0.373	-16.181	74	0.000
	Post-test	75	3.211	0.489			
Inquisitiveness	Pre-test	75	2.531	0.428	-13.763	74	0.000
	Post-test	75	3.353	0.451			
Open-mindedness	Pre-test	75	2.618	0.466	-12.458	74	0.000
	Post-test	75	3.316	0.361			
Systematicity	Pre-test	75	2.627	0.440	-11.893	74	0.000
	Post-test	75	3.324	0.426			
Truth-seeking	Pre-test	75	2.618	0.393	-15.044	74	0.000
	Post-test	75	3.356	0.372			
Total	Pre-test	75	2.529	0.241	-25.480	74	0.000
	Post-test	75	3.263	0.271			

* $p < .05$

Hasil perbandingan nilai pre-test dan post-test pada kelompok kontrol pada Tabel 5 menunjukkan adanya perbedaan signifikan terhadap seluruh komponen yang diuji. Nilai rata-rata post-test yang lebih tinggi daripada nilai rata-rata pre-test menunjukkan bahwa perlakuan yang dilakukan pada kelompok kontrol memberikan pengaruh signifikan terhadap peningkatan nilai setiap komponen.

Tabel 6. Hasil Independent t-test terhadap Nilai Post-test antara Kelompok Eksperimen dan Kelompok Kontrol

Komponen		N	M	SD	t	df	P
Anlitivity	Eksperimen	74	3.329	0.437	2.722	147	0.007
	Kontrol	75	3.151	0.355			
CT-Self Confidence	Eksperimen	74	3.387	0.450	3.665	147	0.000
	Kontrol	75	3.124	0.426			
Mature Judgement	Eksperimen	74	3.421	0.439	2.760	147	0.007
	Kontrol	75	3.211	0.489			
Inquisitiveness	Eksperimen	74	3.547	0.450	2.629	147	0.009
	Kontrol	75	3.353	0.451			
Open-mindedness	Eksperimen	74	3.504	0.442	2.858	147	0.005
	Kontrol	75	3.316	0.361			
Systematicity	Eksperimen	74	3.493	0.492	2.242	147	0.026
	Kontrol	75	3.324	0.426			
Truth-seeking	Eksperimen	74	3.509	0.461	2.237	147	0.027

Komponen		N	M	SD	t	df	P
Total	Kontrol	75	3.355	0.372	3.857	147	0.000
	Eksperimen	74	3.456	0.338			
	Kontrol	75	3.263	0.271			

* $p < .05$

Hasil perbandingan nilai post-test antara kelompok eksperimen dan kelompok kontrol pada Tabel 6 menunjukkan adanya perbedaan signifikan terhadap seluruh komponen yang diuji. Nilai rata-rata kelompok eksperimen yang lebih tinggi daripada nilai rata-rata kelompok kontrol menunjukkan bahwa perlakuan yang dilakukan pada kelompok eksperimen memberikan pengaruh lebih baik terhadap peningkatan nilai setiap komponen.

Pembahasan

Implikasi Teoritis

Penelitian ini mengungkapkan hasil bahwa, dalam kuliah Sains Dasar, pembelajaran collaborative inquiry memiliki dampak signifikan pada pencapaian disposisi berpikir kritis pebelajar. Pendekatan pembelajaran collaborative inquiry membuat disposisi berpikir kritis pebelajar lebih mudah diakses daripada pendekatan konvensional. Ini mungkin dipicu oleh keterlibatan pebelajar secara kolektif dalam memenuhi tujuan bersama. Sebagai pendekatan pedagogik, penyelidikan kolaboratif menekankan pada paradigma konstruktivis, dimana pebelajar memperoleh informasi baru dari teman sebaya mereka dan mendorong penarikan kembali pengetahuan dan materi pelajaran sehingga berkontribusi pada kinerja akademik dan sikap pembelajaran yang lebih efektif (Cooper, 2006). Beberapa studi mengungkapkan bahwa pembelajaran kolaboratif yang dipadukan dengan aktivitas penyelidikan dan pemecahan masalah berkontribusi terhadap hasil belajar kognitif dan afektif (misal: Sukmawati, Setyosari, Sulton, & Purnomo (2019); Pramusinta, Setyosari, Widiawati, & Kuswandi (2019)).

Pada strategi pembelajaran *collaborative inquiry*, pebelajar terlibat secara kolektif dalam mengeksplorasi materi dengan rekan-rekan mereka, memperoleh pengetahuan baru, membandingkan pendapat mereka dengan teman sebaya, mengevaluasi berbagai perspektif dan meningkatkan keterampilan pemecahan masalah mereka. Keterlibatan ini, mendorong pebelajar untuk mengembangkan sikap analitis dan kerja tim, sehingga meningkatkan kemampuan mereka untuk berpikir kritis. Ini konsisten dengan Piaget (1928) dan sejalan dengan penelitian Fung (2017). Piaget (1928) menunjukkan bahwa disonansi kognitif, yang biasanya disebabkan oleh interaksi sosial teman sebaya, memainkan peran penting dalam kultivasi pertumbuhan kognitif dan memperkuat efek pembelajaran. Dalam hal ini, kerja kelompok kolaboratif dapat dianggap sebagai interaksi *peer to peer* yang mendorong pengambilan keputusan dan tanggung jawab bersama melalui konflik kognitif. Fung (2017), membuktikan bahwa lingkungan pembelajaran kolaboratif dapat membantu pebelajar mengembangkan ide-ide baru dengan menekankan peran penting argumen dalam merangsang disposisi berpikir kritis.

Selain itu, Cheng & Wan (2017), juga mengemukakan bahwa keterlibatan pebelajar secara aktif dalam pertukaran ide kontekstual untuk merencanakan,

merancang dan melakukan eksperimen dapat berimplikasi positif pada sikap berpikir kritis. Praktik ini mencerminkan penerapan teori konstruktivis, dimana pebelajar secara mandiri terlibat dalam kerja kolektif dan studi eksperimental untuk memperoleh kemampuan tingkat tinggi.

Hasil analisis data mengkonfirmasi bahwa nilai rata-rata post-test lebih tinggi daripada nilai rata-rata pre-test menunjukkan bahwa perlakuan yang dilakukan pada kelompok eksperimen memberikan pengaruh signifikan terhadap peningkatan nilai setiap komponen. Total skor rata-rata pre tes dan post test yang diperoleh dari kelompok eksperimen $t(74) = 0.000$; $p < 0,05$. Total nilai rata-rata post test kelompok eksperimen ($M = 3,456$, $SD = 0,338$) ditemukan lebih tinggi dari total nilai rata-rata pre-test ($M = 2,509$; $SD = 0,214$). Temuan ini menunjukkan bahwa mata kuliah sains yang dilaksanakan dengan pembelajaran collaborative inquiry efektif dalam meningkatkan disposisi berpikir kritis mahasiswa calon guru IPA. Hasil analisis data juga menunjukkan bahwa ada perbedaan disposisi berpikir kritis antara pebelajar yang terlibat dalam strategi collaborative inquiry dan Strategi konvensional (penulis, ; penulis,)

Analisa 7 item

Implikasi Praktis

Pembelajaran kolaboratif inkuiri membantu pebelajar mengatasi masalah sambil mengembangkan kesadaran dan meningkatkan keberhasilan mereka melalui pengalaman pada akhirnya berkontribusi pada pola pikir yang produktif. Selama latihan penyelidikan, kesadaran pebelajar akan ditingkatkan karena mereka terlibat langsung dalam mengembangkan konten, menemukan masalah, merancang penyelidikan, serta menemukan jawaban. Pebelajar pada kelompok strategi collaborative inquiry learning terlibat dalam penyelidikan kolaboratif sangat tertarik untuk menciptakan dan membangun argumen. Mereka berusaha untuk mencari bukti dari pendapat teman mereka dengan membagikan klaim dan pernyataan masukan serta berpartisipasi dalam diskusi.

Kinerja ini tidak terlepas dari peran instruktur dalam mengatur dan mendorong kerjasama pebelajar selama penyelidikan. Pebelajar telah mendesain ruang kolaborasi bagi pebelajar untuk membuat pengalaman dan ide mereka sendiri, yang pada akhirnya mengatur kebutuhan perancah yang lebih terarah untuk membahas tantangan yang dialami pebelajar dan mengarahkan pebelajar kearah tertentu dalam fase dengan struktur. Bantuan pebelajar seperti menyediakan struktur dan ruang dalam fase penyelidikan kolaboratif dapat meningkatkan kemauan pebelajar untuk berkolaborasi. Dalam arti yang lebih luas peran pebelajar dalam pembelajaran kolaboratif inkuiri sangat penting.

Pebelajar dapat membimbing pebelajar menuju keterbukaan pikiran dan kepercayaan diri dalam menghadapi perbedaan, bahkan terkadang pertentangan opini. Misalnya ketika seorang pebelajar agak terlalu bersemangat dalam menyagkal pendapat teman sekelasnya, menghasilkan suasana kelompok yang tegang, dengan demikian membutuhkan peran pebelajar untuk memecahkan suasana, meminimalisir ketegangan dan mendorong kelompok untuk melanjutkan diskusi. Selanjutnya ketika

pembelajar mengakui komentar informatif satu pebelajar dengan nada setuju, pebelajar lain termotivasi untuk menyumbangkan respon yang bijaksana untuk mendapatkan perlakuan yang serupa.

Di sisi lain, meskipun diajarkan menggunakan metode konservatif dan berpusat pada pembelajar, pebelajar di kelas kontrol memiliki sikap pesimistis. Ini bisa terjadi karena kelas besar mengurangi keterlibatan pebelajar dalam proses belajar. Peneliti menganggap bahwa pengajaran yang berfokus pada pembelajar kurang berhasil karena minim interaksi baik antar pebelajar dengan pebelajar maupun antar pebelajar dengan pembelajar serta antar pebelajar dengan lingkungan sekitar. Lingkungan pembelajaran konvensional kurang memberikan kesempatan kepada pebelajar untuk berbagi, mengkritik atau mengulas argumen. Lent & Brown (2006), berargumen bahwa sikap dengan pandangan perilaku kognitif, afektif dan individu yang diorganisir melalui pengalaman sebelumnya membentuk perspektif seseorang tentang masalah tertentu. Ini berarti bahwa sikap terkait dengan pengalaman baik kepada pebelajar, apakah mereka merasa aktifitas penyelidikan menarik atau tidak dan seberapa banyak kegiatan yang dapat mereka lakukan (Baseya & Francis, 2011). Ketika pebelajar tidak menikmati pembelajaran, mereka cenderung negatif, akhirnya mempengaruhi kinerja akademik mereka. Oleh karena itu, dapat dinyatakan bahwa lingkungan belajar menentukan sikap pebelajar di kedua kelompok.

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Instructional Strategy for critical thinking disposition: preparing prospective elementary teachers in the twenty-first century

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1. Pendahuluan

Saat ini, kolaborasi dan berpikir kritis telah diakui sebagai keterampilan abad 21. Hampir diseluruh negara telah memasukan kedua keterampilan ini sebagai faktor penentu keberhasilan pendidikan (Ahonen & Kinnunen, 2015; van Laar et al., 2020). Di Indonesia, kurikulum berbasis kompetensi telah lama diperkenalkan oleh Kementerian Pendidikan dan Kebudayaan, dengan penekanan pada pembentukan karakter dan sikap ilmiah seperti pemikiran logis, kreatif dan inovatif. Namun **fakta** menunjukkan bahwa pada lulusan perguruan tinggi, kolaborasi dan pemikiran kritis ditemukan sangat terbatas, termasuk siswa calon guru yang dipersiapkan untuk mengajar dimasa depan (**Referensi??**). Pada saat yang sama, sikap dan keterampilan ini diperlukan dalam dunia kerja.

Dikotomi yang bermasalah ini menghadirkan kebutuhan untuk lebih memahami bagaimana kolaborasi dan berpikir kritis diajarkan terutama kepada calon guru sekolah dasar yang siap untuk mengajar siswa mereka di masa depan. Facione (2000), merekomendasikan bahwa pemikiran kritis dapat ditingkatkan melalui pengembangan disposisi berpikir kritis. Siswa yang memiliki kesadaran dan sikap untuk berpikir kritis berpeluang untuk mengasah keterampilan berpikir kritis. Banyak studi telah berfokus pada upaya untuk meningkatkan keterampilan berpikir kritis melalui penerapan strategi pembelajaran (misalnya: Erdogan, 2019; Mahanal et al., 2019; Saputra et al., 2019; Yasin et al., 2019). Namun, sangat sedikit studi yang berfokus pada upaya untuk meningkatkan disposisi berpikir kritis calon guru sekolah dasar. Penelitian menunjukkan bahwa ada hubungan yang signifikan antara kegiatan pembelajaran bagi calon guru dan kegiatan mengajar di sekolah (de Vries et al., 2014; Desimone et al., 2002; Stokking et al., 2003). Siswa calon guru yang terlibat dalam kegiatan pembelajaran aktif akan menginspirasi mereka untuk menerapkannya di sekolah (Agyei & Voogt, 2014; Desimone et al., 2002; Schwarz et al., 2009). Ini berarti guru perlu menanamkan sikap positif terhadap pemikiran kritis. Mereka harus terlebih dahulu menyadari disposisi berpikir kritis mereka dan bertanggung jawab terhadap pekerjaan serta keterampilan berpikir kritis siswa mereka. Guru yang tidak memiliki disposisi berpikir kritis, dengan sendirinya tidak memiliki kemampuan mengajarkan disposisi berpikir kritis kepada siswa mereka (Mohamad et al., 2015). Pernyataan ini didukung oleh (Abrami et al., 2008; Facione, 2000; Unlu, 2018) yang mengemukakan bahwa cara terbaik untuk meningkatkan keterampilan dan disposisi berpikir kritis adalah dengan menerapkannya secara eksplisit melalui aktivitas akademik seperti pelatihan dan pengembangan fakultas.

Hal ini dianggap perlu untuk diselidiki, mengingat kelangkaan literatur tentang kecenderungan berpikir kritis calon guru sekolah dasar. Dengan demikian, untuk mengisi kekosongan dalam literatur, **penelitian ini bertujuan untuk mendorong disposisi berpikir kritis calon guru sekolah dasar dengan menerapkan strategi pembelajaran kolaboratif inkuiri**. Pembelajaran kolaboratif tidak hanya belajar dan bekerja dalam kelompok dengan instruksi guru tetapi proses dimana dua atau lebih orang berinteraksi untuk mengaktifkan kognisi mereka (Dillenbourg, 1999). Dalam berkolaborasi, siswa harus terlibat bersama, mengenali perbedaan pengetahuan,

menyatukan persepsi, dan mencari solusi. Keberhasilan individu dalam kolaborasi terletak pada aktivitas dan usaha intelektual bersama (Laal & Laal, 2012; Lou & Kim MacGregor, 2004). Banyak peneliti telah berfokus pada pembelajaran kolaboratif. Hal ini dipengaruhi oleh karakteristik pembelajaran kolaboratif yang menekankan pada interaksi sosial, keterlibatan intelektual, dan tanggung jawab bersama (Shelton & Rawlings, 1992). Istilah kolaboratif inkuiri adalah sub-kategori dari pembelajaran kolaboratif dan inkuiri. Kata inkuiri berasal dari kata to inquiry yang artinya keterlibatan dalam mengajukan pertanyaan, mencari informasi, dan melakukan investigasi (Lott, 2011). Inkuiri adalah pendekatan kolaboratif untuk memecahkan masalah secara reflektif dan interaktif dimana individu membangun makna dan bersama-sama mengkonfirmasi pemahaman (Garrison, 2016). Menggabungkan pembelajaran kolaboratif dengan pembelajaran inkuiri dapat meningkatkan kinerja yang mengarah pada pengembangan pengetahuan baru (Okada & Simon, 1997; Springer et al., 1999b; van Boxtel et al., 2000). Ada hubungan yang sangat penting antara pembelajaran kolaboratif inkuiri dan disposisi berpikir kritis. Keduanya didasarkan pada kesediaan siswa untuk bertanggung jawab dan memiliki kemampuan untuk membangun makna serta memvalidasi informasi. Disposisi berpikir kritis merupakan semangat jiwa dan motivasi diri untuk aktif dan secara sistematis terlibat dalam verifikasi masalah, memahami masalah, mencari dan mempertimbangkan bukti, serta evaluasi. Dalam konteks pembelajaran kata disposisi mengarah pada pengaturan diri dan keterlibatan aktif dalam pencarian kebenaran sementara istilah berpikir kritis berkontribusi pada kemampuan siswa untuk memeriksa, mengevaluasi, mengkritik, mempromosikan konsep berdasarkan fakta yang valid.

Disposisi berpikir kritis sangat diperlukan untuk mengantarkan mahasiswa calon guru sekolah dasar untuk berpikir kritis. Ini tidak hanya untuk kebutuhan pribadi mereka tetapi juga untuk masa depan generasi mereka. Hal ini, dapat dicapai jika mereka dilatih untuk terlibat bersama dalam merencanakan, merancang dan melakukan penyelidikan. Oleh karena itu, penelitian ini bertujuan untuk menyelidiki pengaruh collaborative inquiry learning terhadap disposisi berpikir kritis mahasiswa calon guru sains sekolah dasar. Adapun pertanyaan penelitian ini adalah

RQ1: Apakah ada perbedaan yang signifikan antara skor pre-test dan post test kelompok eksperimen dalam hal disposisi berpikir kritis?

RQ2: Apakah ada perbedaan yang signifikan antara skor pre-test dan post test kelompok kontrol dalam hal disposisi berpikir kritis?

RQ3: Apakah ada perbedaan yang signifikan antara skor post test kelompok eksperimen dan kelompok kontrol dalam hal disposisi berpikir kritis?

2. Literature Review

2.1 Berpikir Kritis (CT) dan Disposisi Berpikir Kritis (CTD)

Ada beberapa pandangan yang berbeda terkait dengan definisi berpikir kritis. Perbedaan ini, membutuhkan pertimbangan yang kritis untuk menarik kesimpulan yang tepat. Berpikir kritis menurut Kurfiss, (1988) adalah respon rasional terhadap pertanyaan yang tidak dapat dijawab secara pasti. Kurfiss, (1988) menegaskan bahwa dalam berpikir kritis investigasi menjadi fokus utama dalam mengeksplorasi situasi, fenomena, pertanyaan atau masalah untuk sampai pada hipotesis atau kesimpulan secara masuk akal. Paul (1982), mengemukakan bahwa dalam berpikir kritis kecerdasan intelektual dan kerendahan hati merupakan dasar untuk memahami dunia

yang berbeda secara holistik. Menurut Paul, proses berpikir kritis diawali dengan seseorang melihat berbagai hal dari perspektif yang berbeda, dan menemukan solusi berdasarkan kesepakatan bersama. Berpikir kritis adalah proses menganalisis dan menilai pemikiran dengan maksud untuk meningkatkannya. Kunci untuk sisi kreatif dari berpikir kritis adalah restrukturisasi berpikir sebagai hasil dari menganalisa dan menilai secara efektif (Paul & Elder, 2005).

Ennis (2014) mendefinisikan pemikiran kritis sebagai pemikiran reflektif yang masuk akal yang terfokus pada memutuskan apa yang harus di percaya atau lakukan. Pemikiran reflektif berarti secara sadar dan sukarela mempertimbangkan segala hal secara aktif, gigih dan hati-hati sebelum mengambil keputusan dan membuat kesimpulan. Proses pengambilan keputusan membutuhkan keterampilan mengamati, menyimpulkan, mengeneralisasikan, membuat penalaran dan melakukan evaluasi sedangkan untuk menarik kesimpulan benar dan masuk akal di butuhkan bukti-bukti yang relevan berdasarkan pertimbangan secara aktif, tekun dan hati-hati. Siegel menguatkan pandangan Paul dan Ennis bahwa dalam berpikir kritis tidak hanya keterampilan yang di butuhkan tetapi juga dibutuhkan alasan dan kekuatan alasan untuk membenarkan keyakinan, klaim dan tindakan (Bellous, 1991)

. Baik Paul, Ennis maupun Siegel, ketiganya memiliki konsep yang sama terkait dengan proses berpikir kritis diantaranya: 1) dimulai dengan proses penalaran yang melibatkan kecerdasan intelektual dan kerendahan hati 2) pemecahan masalah secara holistik dan interaktif; 3) pengambilan keputusan berdasarkan pada bukti dan pertimbangan nilai. Dengan berlandaskan definisi tersebut para ahli lainnya seperti Ahrari, Samah, Hassan, Wahat, & Zaremohzzabieh (2016), mengemukakan bahwa seseorang dapat dikatakan sebagai pemikir kritis jika ia mampu berpikir dan mengeksplorasi ide-ide baru, mengambil keputusan berdasarkan bukti-bukti, bertindak secara dinamis, produktif, sensitif dan kreatif. Pemikir kritis mampu mengenali kekuatan dan kelemahan dirinya, bersedia memberikan pandangan, berpikiran terbuka, mampu membedakan yang baik atau yang buruk, mampu mengeksplorasi, jujur dan percaya diri serta fleksibel. Sikap waspada dan skeptis terhadap pernyataan, komentar dan argumen yang tidak dibuktikan kebenarannya juga merupakan bagian dari berpikir kritis.

Berpikir kritis sangat dibutuhkan di dunia kerja sehingga menarik banyak orang untuk melakukan penelitian tentang berpikir kritis. Namun untuk mencapai pada pemikir kritis di perlukan disposisi berpikir kritis (Ennis, 1996; Zooler, et al,2000). Menurut Ennis (1985), disposisi berpikir kritis merupakan motivasi atau semangat untuk berpikir kritis. Kata disposisi memiliki makna kecenderungan untuk melakukan sesuatu dan mengingat kondisi tertentu (Ennis, 1996). Disposisi digunakan oleh pemikir kritis untuk menerapkan kemampuan berpikir kritis pada pemikiran sendiri dan pemikiran orang lain. Disposisi sangat dibutuhkan dalam pembelajaran di kelas karena merupakan media penghubung kemampuan berpikir kritis. Ben-Chaim et al., (2000), mengemukakan bahwa disposisi berpikir kritis dapat memberikan pengaruh dalam pendidikan. Dengan demikian, pendidik tidak hanya mengasah keterampilan kognitif, tetapi juga memberikan penguatan pada cara berpikir kritis.

Penguatan diberikan melalui motivasi, kecenderungan dan dorongan untuk terlibat dalam pemikiran kritis dengan berfokus pada masalah penting, membuat keputusan dan menyelesaikan masalah. Aspek-aspek tersebut merupakan bagian penting dari disposisi berpikir kritis (Facione et al, 1995, (Facione et al., 1996)). Selain aspek-aspek tersebut Ennis (1999), juga mengemukakan bahwa kemampuan mengajukan pertanyaan, membangun konsep yang kompleks, melakukan klarifikasi,

memahami konsep juga merupakan disposisi berpikir kritis. Ennis (1999), memperjelas pendapat Perkins, Jay dan Tisman (1993) yang menawarkan tiga komponen dalam disposisi berpikir kritis yakni kecenderungan, sensitivitas dan kemampuan. Menurut Ennis (1999) sensitivitas dan kemampuan kurang dibutuhkan dalam disposisi berpikir kritis. Ennis kemudian menawarkan sistem penilaian yang sederhana yang telah dikembangkan oleh beberapa ahli (misal: Perkins, Jay & Tisman, 1993; Facione & Facione, 1992). Menurut Ennis (1996), pemikir ideal cenderung untuk peduli bahwa mereka dapat melakukan sesuatu dengan benar dan dapat dipertanggungjawabkan, jujur dan jelas, peduli terhadap martabat dan nilai setiap individu. Disposisi berpikir kritis sangat penting diajarkan di dunia pendidikan. Terutama di pendidikan tinggi. Lulusan perguruan tinggi harus memiliki kemampuan berpikir kritis yang nantinya digunakan di dunia kerja. Mahasiswa calon guru sangat dianjurkan untuk memiliki keterampilan berpikir kritis termasuk disposisi berpikir kritis, karena pengetahuan dan keterampilan berpikir kritis yang diperoleh akan ditularkan kepada siswa. Pentingnya disposisi berpikir kritis ini, menarik beberapa peneliti untuk melakukan penelitian tentang disposisi berpikir kritis guru dan calon guru. Penelitian yang dilakukan oleh (Demirhan & Köklükaya, 2014), menunjukkan bahwa calon guru sains memiliki kemampuan berpikir kritis pada taraf menengah dan rendah. Hasil penelitian ini merekomendasikan bahwa perlu adanya model, strategi, pendekatan dan metode untuk meningkatkan keterampilan berpikir kritis calon guru sains. Hasil penelitian ini sejalan dengan penelitian sebelumnya yang dilakukan oleh (Kezer & Turker, 2012), terkait dengan disposisi berpikir kritis calon guru sains di Turki. Penelitian yang dilakukan oleh (Arsal, 2017), tentang pengaruh pembelajaran *inquiry* terhadap disposisi berpikir kritis calon guru dengan metode *quasi* eksperimen menunjukkan bahwa tidak ada pengaruh yang signifikan antara pembelajaran berbasis *inquiry* dengan disposisi berpikir kritis calon guru, meskipun terjadi peningkatan disposisi berpikir kritis. Hasil ini bertentangan dengan beberapa penelitian sebelumnya seperti (Kwan & Wong, 2015) dan (Zhou et al., 2010) serta Thaiposri & Wannapiron, (2015) yang menemukan bahwa pembelajaran berbasis *inquiry* secara positif mempengaruhi disposisi berpikir kritis calon guru.

2.2 Collaborative Inquiry Learning

Pembelajaran kolaboratif tidak hanya belajar dan bekerja dalam kelompok dengan instruksi guru tetapi proses dimana dua atau lebih orang berinteraksi untuk mengaktifkan kognisi mereka (Dillenbourg, 1999). Dalam berkolaborasi, siswa harus terlibat bersama, mengenali perbedaan pengetahuan, menyatukan persepsi, dan mencari solusi. Keberhasilan individu dalam kolaborasi terletak pada aktivitas dan usaha intelektual bersama (Laal & Laal, 2012; Lou & Kim MacGregor, 2004).

Di era pembelajaran kolaboratif saat ini yang ditemukan lebih menonjol, banyak peneliti pedagogis yang berfokus pada pembelajaran kolaboratif. Hal ini dipengaruhi oleh karakteristik pembelajaran kolaboratif yang menekankan pada interaksi sosial, keterlibatan intelektual, dan tanggung jawab bersama (Shelton & Rawlings, 1992) - seiring dengan berkembangnya istilah penelitian pendidikan kolaboratif, kemudian dipadukan dengan beberapa metode pembelajaran, misalnya kolaboratif pembelajaran inkuiri. Istilah inkuiri kolaboratif adalah sub-kategori dari pembelajaran kolaboratif dan inkuiri. Kata inkuiri berasal dari kata inkuiri yang artinya keterlibatan dalam mengajukan pertanyaan, mencari informasi, dan melakukan investigasi (Lott, 2011). Penyelidikan adalah pendekatan kolaboratif untuk memecahkan masalah

dengan cara reflektif dan interaktif di mana individu membangun makna dan bersama-sama mengkonfirmasi pemahaman (Garrison, 2016).

Menggabungkan pembelajaran kolaboratif dengan pembelajaran inkuiri dapat meningkatkan kinerja yang mengarah pada pengembangan pengetahuan baru (misalnya, (Okada & Simon, 1997; Springer et al., 1999b; van Boxtel et al., 2000). Ketika siswa berkolaborasi, mereka dapat bertukar pikiran, bertanya, memberikan penjelasan, dan bernegosiasi. Dalam melaksanakan pembelajaran inkuiri kolaboratif, pembelajaran memerlukan persiapan dari peserta didik. Peran guru seaktif peran siswa, dan guru harus aktif dalam memenuhi kebutuhan siswa. Selama inkuiri kolaboratif Kegiatan seperti perencanaan pembelajaran, menciptakan iklim kolaborasi, dorongan, dan motivasi adalah tugas utama peserta didik (Urhahne et al., 2010) Peserta didik yang merancang pembelajaran sebelum mengajar dapat berkontribusi pada pemahaman siswa (van Uum et al., 2017). Peserta didik harus memastikan bahwa lingkungan belajar termasuk media dan sumber belajar sudah sesuai dengan kegiatan inkuiri Peserta didik perlu menguasai semua peralatan yang digunakan, meliputi perangkat, bahan ajar, dan langkah-langkah pembelajaran.

Research Methodology

Research Design

Kuasi eksperimen dengan pre-test/post-test *control group design* digunakan dalam penelitian ini. Empat kelas paralel diberikan intervensi selama 12 minggu pada bulan Agustus hingga Nopember 2019. Dua kelas paralel sebagai kelompok eksperimen yang diajarkan dengan pembelajaran kolaboratif inkuiri. Sementara dua kelas lainnya sebagai kelompok kontrol yang diajarkan dengan inkuiri konvensional. Pembelajaran kolaboratif inkuiri dan konvensional sebagai variabel independen sedangkan disposisi berpikir kritis sebagai variabel dependen. California Critical Thinking Disposition (CCTD) (Facione et al, 1999) digunakan untuk menilai disposisi berpikir kritis mahasiswa calon guru sains Sekolah Dasar sebelum dan setelah intervensi.

Sample / Participants / Group

Penelitian ini melibatkan 149 mahasiswa program Pendidikan Guru Sekolah Dasar Universitas Khairun Ternate Indonesia. Mereka adalah mahasiswa tahun pertama yang mengikuti kuliah sains dasar. Mereka dibagi menjadi dua kelompok yakni kelompok eksperimen (N=74) dan kelompok kontrol (N=75). Pembagian ini didasarkan pada data....yang diperoleh melalui form identitas pribadi dan skor pre-test disposisi berpikir kritis. Hasil uji t sampel independen data pre-test menunjukkan bahwa dua kelompok ini memiliki disposisi berpikir kritis yang setara ($t(149) = -0,528; p > 0,05$).

Instrument and Procedures

Dalam pengukuran disposisi berpikir kritis digunakan instrumen penilaian berupa angket dengan skala bertingkat. Instrumen tersebut disusun dalam bentuk

pernyataan dengan jumlah item sebanyak 49. Pernyataan Angket bersumber dari tujuh kebiasaan berpikir yang dikemukakan oleh Facione yakni pencarian kebenaran, pikiran terbuka, analitik, sistematis keingintahuan, kepercayaan diri dan kedewasaan. Instrumen tersebut disusun menggunakan skala likert. Instrumen ini dikembangkan dengan mengadaptasi dari instrumen yang telah dikembangkan oleh Sosu (2013) dan Shin, Park & Kim, (2015). Kedua instrumen ini dijadikan rujukan karena pengembangan instrumennya didasarkan pada indikator disposisi berpikir kritis yang dikembangkan oleh beberapa ahli seperti Halpern (1998); Ennis (1996); Facione & Facione (1994).

Procedures

Penelitian ini diawali dengan kegiatan *focus group discussion* (FGD) antar dosen pengampu mata kuliah, peneliti dan observer. FGD dilakukan untuk memastikan bahwa semua perangkat-perangkat, alat dan media serta sarana pendukung telah disiapkan. Penentuan waktu pelaksanaan penelitian dan pembagian tugas tim peneliti juga disepakati pada kegiatan FGD.

Setelah melakukan FGD, peneliti kemudian menghubungi mahasiswa dan melakukan tindakan awal yakni membuat kesepakatan melalui pengisian formulir kontrak belajar, pengisian instrumen data diri yang mencakup nama, tempat tanggal lahir, jenis kelamin, asal dan sebagainya. Selanjutnya, peserta dari kelompok eksperimen dan kelompok kontrol diberi pelatihan singkat tentang prosedur dan langkah-langkah pembelajaran kolaboratif inkuiri. Peneliti juga memberi penjelasan tentang prinsip-prinsip kerja sama tim.

Proses penelitian ditetapkan pada semester ganjil sebanyak 16 kali pertemuan, mulai dari tahap pre-test, tahap treatment hingga tahap post-test. Kegiatan pre-test dilakukan minggu pertama dengan cara membagikan angket disposisi berpikir kritis kepada mahasiswa satu minggu sebelum dilakukan perlakuan. Selanjutnya, tahap treatment dilakukan pada kelompok eksperimen dan kelompok kontrol. Pada pertemuan pertama guru memberikan penguatan langkah-langkah metode ilmiah untuk memperkuat keterampilan penyelidikan. Sesi perkuliahan selama 14 minggu dengan total 340 jam pelajaran dilaksanakan secara tatap muka, non tatap muka, dan penyelidikan lapangan atau laboratorium. Aktivitas pembelajaran kolaboratif inkuiri didesain dengan melibatkan mahasiswa untuk mempelajari konsep, merancang penyelidikan, melakukan penyelidikan di laboratorium maupun di lingkungan terbuka dan membuat laporan secara berkelompok. Setiap anggota kelompok diberikan waktu untuk menyiapkan setiap unit kegiatan penyelidikan dengan mempelajari informasi sebelum perkuliahan dimulai pada pertemuan berikutnya. Pengetahuan konseptual awal setiap anggota kelompok digunakan sebagai bahan diskusi kelompok dalam merancang dan melakukan penyelidikan. Peneliti merancang intervensi dan menyediakan instruktur dengan semua bahan yang diperlukan.

Dalam penelitian ini, Langkah-langkah pembelajaran *collaborative inquiry* diadaptasi dari beberapa sumber seperti Cash, Dekonick, & Ahmed-Kristenen, 2017, Khine & Saleh (2010) dan Padaste et al (2015). Ada lima fase pembelajaran *collaborative inquiry* yakni fase orientasi, konseptualisasi, investigasi, kesimpulan dan diskusi. Fase orientasi merupakan proses untuk mengidentifikasi dan mendorong rasa ingin tahu siswa tentang topik yang diajarkan. Pada fase ini instruktur membagi siswa dalam kelompok-kelompok kecil secara heterogen, memberikan tugas penyelidikan, menyampaikan instruksi. Siswa bekerja secara berkelompok, berbagi tugas, melakukan brainstorming, menentukan masalah untuk diselesaikan serta menetapkan tujuan bersama.

Selanjutnya, pada fase konseptualisasi siswa berdiskusi dalam kelompok untuk merumuskan masalah atau pertanyaan, merumuskan hipotesis berdasarkan teori. Proses ini dilakukan dengan berbagi pemahaman bersama tentang topik melalui komunikasi dan interaksi sosial. Anggota tim dari masing-masing kelompok menguraikan konteks penyelidikan dan gagasan mereka untuk memperbaiki serta mengembangkan rencana disain. Proses ini disebut fase investigasi yang secara ringkas diawali dengan kegiatan eksplorasi, dilanjutkan dengan eksperimen dan diakhiri dengan interpretasi.

Setelah melalui fase investigasi, fase berikutnya adalah proses untuk membuat kesimpulan berdasarkan data serta membandingkan kesimpulan berdasarkan data dengan hipotesis atau pertanyaan penelitian. Hasil temuan-temuan tersebut disajikan dalam bentuk laporan yang akan didiskusikan kepada kelompok lainnya pada fase diskusi. Adapun instruksi pembelajaran collaborative inquiry digambarkan dalam tabel berikut ini:

Tabel 1.1. Langkah-langkah pembelajaran sains dasar PGSD menggunakan Strategi Pembelajaran kolaboratif inkuiri

Tahap	Kegiatan Pembelajaran	Aktifitas pebelajar
Orientasi	<ol style="list-style-type: none"> 1. pembelajar menyampaikan tujuan pembelajaran 2. Menyediakan ruang kerja dan Fasilitas Belajar 3. Membagi pebelajar dalam kelompok keCoIL 3-4 orang (kelompok heterogen) 4. pembelajar membagikan topik/masalah/pertanyaan untuk didiskusikan 5. Menyampaikan instruksi keterampilan penyelidikan dan keterampilan ilmiah 	<ol style="list-style-type: none"> 1. Mengenali tujuan utama dari pembelajaran 2. Mengambil posisi secara berkelompok 3. Mendiskusikan tugas yang dibagikan 4. Diskusikan semua topik/pertanyaan/masalah 5. Identifikasi topik melalui <i>brainstorming</i> 6. Menentukan skala prioritas 7. Mengenali tantangan tugas 8. Menetapkan tujuan bersama
Konseptualisasi	<ol style="list-style-type: none"> 1. Membagikan bahan ajar 2. Melakukan pendampingan dan pembimbingan 3. Memberikan dukungan motivasi dan co-eksistensi 	<ol style="list-style-type: none"> 1. Berbagi pemahaman bersama tentang topik melalui komunikasi 2. Pelajari konten yang dipilih 3. Diskusikan semua hal tentang konten 4. Kumpulkan perspektif pendapat yang berbeda 5. Urutkan setiap pendapat dalam bentuk tabel 6. Buat persetujuan melalui peta konsep 7. Merumuskan pertanyaan atau

		hipotesis 8. Pilih dan kembangkan rencana desain 9. Identifikasi sumber daya yang dibutuhkan 10. Pertimbangkan informasi awal untuk memvalidasi rencana desain
Investigasi	1. Minta pebelajar untuk mengorganisir ide-ide secara alami 2. Memastikan pebelajar saling berbagi 3. Memberikan dukungan motivasi	1. Menguraikan informasi dan gagasan untuk memperbaiki dan mengembangkan rencana desain 2. Menetapkan langkah-langkah eksplorasi dan eksperimen 3. Mengidentifikasi dan menetapkan tugas berdasarkan sumber daya dan keahlian 4. Berkolaborasi dengan instruktur untuk memperoleh gagasan 5. Melakukan eksplorasi dan eksperimen berdasarkan tugas dan langkah-langkah yang ditetapkan 6. Mengumpulkan bukti: menentukan jenis data
Diskusi & Kesimpulan	Membimbing pebelajar untuk membuat kesimpulan	1. Kesepakatan tim untuk membuat kesimpulan berdasarkan data 2. Membandingkan kesimpulan dengan hipotesis yang dibuat

Data Analysis

Analisis Data

Uji normalitas menggunakan Kolmogorov-Smirnov dilakukan pertama kali dalam analisis data untuk menguji distribusi normal dari data. Pengujian dilanjutkan dengan uji homogenitas ragam menggunakan Levene untuk menguji homogenitas ragam antar kelompok. Berdasarkan hasil uji normalitas dan uji homogenitas ragam akan ditentukan apakah uji parametrik dapat digunakan atau tidak. Pengujian secara parametrik menggunakan paired t-test untuk membandingkan pre test dan post test, kemudian independent t-test untuk membandingkan antar kelompok.

Hasil Analisis

Tabel 1. Hasil Uji Normalitas dengan Kolmogorov-Smirnov

Komponen			K-S	P
Anlitivity	Pre-test	Eksperimen	0.095	0.094
		Kontrol	0.097	0.079

	Post-test	Eksperimen	0.085	0.200
		Kontrol	0.094	0.095
CT-Self Confidence	Pre-test	Eksperimen	0.100	0.064
		Kontrol	0.085	0.200
	Post-test	Eksperimen	0.091	0.200
		Kontrol	0.088	0.200
Mature Judgement	Pre-test	Eksperimen	0.098	0.076
		Kontrol	0.090	0.200
	Post-test	Eksperimen	0.096	0.090
		Kontrol	0.093	0.171
Inquisitiveness	Pre-test	Eksperimen	0.091	0.200
		Kontrol	0.094	0.098
	Post-test	Eksperimen	0.096	0.089
		Kontrol	0.081	0.200
Open-mindedness	Pre-test	Eksperimen	0.094	0.176
		Kontrol	0.097	0.075
	Post-test	Eksperimen	0.091	0.200
		Kontrol	0.091	0.199
Systematicity	Pre-test	Eksperimen	0.097	0.079
		Kontrol	0.083	0.200
	Post-test	Eksperimen	0.100	0.065
		Kontrol	0.100	0.061
Truth-seeking	Pre-test	Eksperimen	0.087	0.200
		Kontrol	0.092	0.184
	Post-test	Eksperimen	0.083	0.200
		Kontrol	0.091	0.198
Total	Pre-test	Eksperimen	0.094	0.168
		Kontrol	0.094	0.168
	Post-test	Eksperimen	0.090	0.200
		Kontrol	0.090	0.200

Hasil pengujian normalitas dengan Kolmogorov-Smirnov pada Tabel 1 menunjukkan data yang digunakan berdistribusi normal ($p > 0.05$) terhadap seluruh komponen disposisi berpikir kritis pada masing-masing kelompok yang diuji, baik pada nilai pre-test maupun nilai post-test. Tabel 2 menyajikan hasil tes Levene pada skor perolehan skor pre-test dan post test yang diperoleh oleh kelompok eksperimen dan kontrol dari CTD.

Tabel 2. Hasil Uji Homogenitas Ragam dengan Levene

Komponen		F	df1	df2	P
Anlitivity	Pre-test	0.001	1	147	0.973
	Post-test	3.522	1	147	0.063
CT-Self Confidence	Pre-test	1.035	1	147	0.311

	Post-test	0.385	1	147	0.536
Mature Judgement	Pre-test	0.066	1	147	0.797
	Post-test	0.354	1	147	0.553
Inquisitiveness	Pre-test	0.156	1	147	0.693
	Post-test	0.007	1	147	0.932
Open-mindedness	Pre-test	0.166	1	147	0.684
	Post-test	3.463	1	147	0.065
Systematicity	Pre-test	2.640	1	147	0.106
	Post-test	1.349	1	147	0.247
Truth-seeking	Pre-test	1.778	1	147	0.184
	Post-test	3.491	1	147	0.064
Total	Pre-test	2.766	1	147	0.098
	Post-test	3.492	1	147	0.064

Seperti yang ditunjukkan pada table 2, varians dalam skor pre-test dan post-test dari kelompok eksperimen dan control dari total komponen CTD menunjukkan data homogen. Secara umum, hasil goodness of fit Kolmogorof-Smirnov dan Uji Levene mengungkapkan bahwa uji parametric dapat digunakan untuk menganalisis data yang diperoleh dari penelitian. Tabel 3. Menyajikan hasil uji-t sampel independent pada skor pra-test dari kelompok eksperimen dan control dari CTD.

Tabel 3. Hasil Independent t-test terhadap Nilai Pre-test antara Kelompok Eksperimen dan Kelompok Kontrol

Komponen		N	M	SD	t	df	P
Anlitivity	Eksperimen	74	2.498	0.377	1.386	147	0.168
	Kontrol	75	2.413	0.366			
CT-Self Confidence	Eksperimen	74	2.703	0.370	0.680	147	0.497
	Kontrol	75	2.658	0.431			
Mature Judgement	Eksperimen	74	2.270	0.355	0.472	147	0.638
	Kontrol	75	2.242	0.373			
Inquisitiveness	Eksperimen	74	2.516	0.406	-0.225	147	0.822
	Kontrol	75	2.531	0.428			
Open-mindedness	Eksperimen	74	2.541	0.441	-1.039	147	0.300
	Kontrol	75	2.618	0.466			
Systematicity	Eksperimen	74	2.523	0.363	-1.572	147	0.118
	Kontrol	75	2.627	0.440			
Truth-seeking	Eksperimen	74	2.511	0.455	-1.525	147	0.129
	Kontrol	75	2.617	0.393			
Total	Eksperimen	74	2.509	0.214	-0.528	147	0.598
	Kontrol	75	2.529	0.241			

* $p < .05$

Hasil perbandingan nilai pre-test antara kelompok eksperimen dan kelompok kontrol pada Tabel 3 menunjukkan tidak adanya perbedaan signifikan terhadap seluruh komponen yang diuji.

Hasil perbandingan nilai pre-test dan post-test pada kelompok eksperimen pada Tabel 4 menunjukkan adanya perbedaan signifikan terhadap seluruh komponen yang diuji.

Tabel 4. Hasil Paired t-test terhadap Nilai Pre-test dan Post-test pada Kelompok Eksperimen

Komponen		N	M	SD	T	df	P
Anlitivity	Pre-test	74	2.498	0.377	-14.105	73	0.000*
	Post-test	74	3.329	0.437			
CT-Self Confidence	Pre-test	74	2.703	0.370	-10.504	73	0.000*
	Post-test	74	3.387	0.450			
Mature Judgement	Pre-test	74	2.270	0.355	-18.723	73	0.000*
	Post-test	74	3.421	0.439			
Inquisitiveness	Pre-test	74	2.516	0.406	-13.880	73	0.000*
	Post-test	74	3.547	0.450			
Open-mindedness	Pre-test	74	2.541	0.441	-14.847	73	0.000*
	Post-test	74	3.504	0.442			
Systematicity	Pre-test	74	2.527	0.367	-13.798	73	0.000*
	Post-test	74	3.493	0.492			
Truth-seeking	Pre-test	74	2.511	0.455	-14.230	73	0.000*
	Post-test	74	3.509	0.461			
Total	Pre-test	74	2.509	0.214	-21.146	73	0.000*
	Post-test	74	3.456	0.338			

* p < .05

Tabel 5. Hasil Paired t-test terhadap Nilai Pre-test dan Post-test pada Kelompok Kontrol

Komponen		N	M	SD	t	df	P
Anlitivity	Pre-test	75	2.413	0.366	-14.668	74	0.000
	Post-test	75	3.151	0.355			
CT-Self Confidence	Pre-test	75	2.658	0.431	-9.077	74	0.000
	Post-test	75	3.124	0.426			
Mature Judgement	Pre-test	75	2.242	0.373	-16.181	74	0.000
	Post-test	75	3.211	0.489			
Inquisitiveness	Pre-test	75	2.531	0.428	-13.763	74	0.000
	Post-test	75	3.353	0.451			
Open-mindedness	Pre-test	75	2.618	0.466	-12.458	74	0.000
	Post-test	75	3.316	0.361			
Systematicity	Pre-test	75	2.627	0.440	-11.893	74	0.000
	Post-test	75	3.324	0.426			
Truth-seeking	Pre-test	75	2.618	0.393	-15.044	74	0.000
	Post-test	75	3.356	0.372			
Total	Pre-test	75	2.529	0.241	-25.480	74	0.000
	Post-test	75	3.263	0.271			

* $p < .05$

Hasil perbandingan nilai pre-test dan post-test pada kelompok kontrol pada Tabel 5 menunjukkan adanya perbedaan signifikan terhadap seluruh komponen yang diuji. Nilai rata-rata post-test yang lebih tinggi daripada nilai rata-rata pre-test menunjukkan bahwa perlakuan yang dilakukan pada kelompok kontrol memberikan pengaruh signifikan terhadap peningkatan nilai setiap komponen.

Tabel 6. Hasil Independent t-test terhadap Nilai Post-test antara Kelompok Eksperimen dan Kelompok Kontrol

Komponen		N	M	SD	t	df	P
Anlitivity	Eksperimen	74	3.329	0.437	2.722	147	0.007
	Kontrol	75	3.151	0.355			
CT-Self Confidence	Eksperimen	74	3.387	0.450	3.665	147	0.000
	Kontrol	75	3.124	0.426			
Mature Judgement	Eksperimen	74	3.421	0.439	2.760	147	0.007
	Kontrol	75	3.211	0.489			
Inquisitiveness	Eksperimen	74	3.547	0.450	2.629	147	0.009
	Kontrol	75	3.353	0.451			
Open-mindedness	Eksperimen	74	3.504	0.442	2.858	147	0.005
	Kontrol	75	3.316	0.361			
Systematicity	Eksperimen	74	3.493	0.492	2.242	147	0.026
	Kontrol	75	3.324	0.426			
Truth-seeking	Eksperimen	74	3.509	0.461	2.237	147	0.027

Komponen		N	M	SD	t	df	P
Total	Kontrol	75	3.355	0.372	3.857	147	0.000
	Eksperimen	74	3.456	0.338			
	Kontrol	75	3.263	0.271			

* $p < .05$

Hasil perbandingan nilai post-test antara kelompok eksperimen dan kelompok kontrol pada Tabel 6 menunjukkan adanya perbedaan signifikan terhadap seluruh komponen yang diuji. Nilai rata-rata kelompok eksperimen yang lebih tinggi daripada nilai rata-rata kelompok kontrol menunjukkan bahwa perlakuan yang dilakukan pada kelompok eksperimen memberikan pengaruh lebih baik terhadap peningkatan nilai setiap komponen.

Pembahasan

Penelitian ini mengungkapkan hasil bahwa, dalam kuliah Sains Dasar, pembelajaran collaborative inquiry memiliki dampak signifikan pada pencapaian disposisi berpikir kritis pebelajar. Pendekatan pembelajaran collaborative inquiry membuat disposisi berpikir kritis pebelajar lebih mudah diakses daripada pendekatan konvensional. Ini mungkin dipicu oleh keterlibatan pebelajar secara kolektif dalam memenuhi tujuan bersama. Sebagai pendekatan pedagogik, penyelidikan kolaboratif menekankan pada paradigma konstruktivis, dimana pebelajar memperoleh informasi baru dari teman sebaya mereka dan mendorong penarikan kembali pengetahuan dan materi pelajaran sehingga berkontribusi pada kinerja akademik dan sikap pembelajaran yang lebih efektif (Cooper, 2006). Beberapa studi mengungkapkan bahwa pembelajaran kolaboratif yang dipadukan dengan aktivitas penyelidikan dan pemecahan masalah berkontribusi terhadap hasil belajar kognitif dan afektif (misal: Sukmawati, Setyosari, Sulton, & Purnomo (2019); Pramusinta, Setyosari, Widiawati, & Kuswandi (2019)).

Pada strategi pembelajaran *collaborative inquiry*, pebelajar terlibat secara kolektif dalam mengeksplorasi materi dengan rekan-rekan mereka, memperoleh pengetahuan baru, membandingkan pendapat mereka dengan teman sebaya, mengevaluasi berbagai perspektif dan meningkatkan keterampilan pemecahan masalah mereka. Keterlibatan ini, mendorong pebelajar untuk mengembangkan sikap analitis dan kerja tim, sehingga meningkatkan kemampuan mereka untuk berpikir kritis. Ini konsisten dengan Piaget (1928) dan sejalan dengan penelitian Fung (2017). Piaget (1928) menunjukkan bahwa disonansi kognitif, yang biasanya disebabkan oleh interaksi sosial teman sebaya, memainkan peran penting dalam kultivasi pertumbuhan kognitif dan memperkuat efek pembelajaran. Dalam hal ini, kerja kelompok kolaboratif dapat dianggap sebagai interaksi *peer to peer* yang mendorong pengambilan keputusan dan tanggung jawab bersama melalui konflik kognitif. Fung (2017), membuktikan bahwa lingkungan pembelajaran kolaboratif dapat membantu pebelajar mengembangkan ide-ide baru dengan menekankan peran penting argumen dalam merangsang disposisi berpikir kritis.

Selain itu, Cheng & Wan (2017), juga mengemukakan bahwa keterlibatan pebelajar secara aktif dalam pertukaran ide kontekstual untuk merencanakan,

merancang dan melakukan eksperimen dapat berimplikasi positif pada sikap berpikir kritis. Praktik ini mencerminkan penerapan teori konstruktivis, dimana pembelajar secara mandiri terlibat dalam kerja kolektif dan studi eksperimental untuk memperoleh kemampuan tingkat tinggi.

Hasil analisis data mengkonfirmasi bahwa nilai rata-rata post-test lebih tinggi daripada nilai rata-rata pre-test menunjukkan bahwa perlakuan yang dilakukan pada kelompok eksperimen memberikan pengaruh signifikan terhadap peningkatan nilai setiap komponen. Total skor rata-rata pre tes dan post test yang diperoleh dari kelompok eksperimen $t(74) = 0.000$; $p < 0,05$. Total nilai rata-rata post test kelompok eksperimen ($M = 3,456$, $SD = 0,338$) ditemukan lebih tinggi dari total nilai rata-rata pre-test ($M = 2,509$; $SD = 0,214$). Temuan ini menunjukkan bahwa mata kuliah sains yang dilaksanakan dengan pembelajaran collaborative inquiry efektif dalam meningkatkan disposisi berpikir kritis mahasiswa calon guru IPA. Hasil analisis data juga menunjukkan bahwa ada perbedaan disposisi berpikir kritis antara pembelajar yang terlibat dalam strategi collaborative inquiry dan Strategi konvensional.

Pembelajaran kolaboratif inkuiri membantu pembelajar mengatasi masalah sambil mengembangkan kesadaran dan meningkatkan keberhasilan mereka melalui pengalaman pada akhirnya berkontribusi pada pola pikir yang produktif. Selama latihan penyelidikan, kesadaran pembelajar akan ditingkatkan karena mereka terlibat langsung dalam mengembangkan konten, menemukan masalah, merancang penyelidikan, serta menemukan jawaban. Pembelajar pada kelompok strategi collaborative inquiry learning terlibat dalam penyelidikan kolaboratif sangat tertarik untuk menciptakan dan membangun argumen. Mereka berusaha untuk mencari bukti dari pendapat teman mereka dengan membagikan klaim dan pernyataan masukan serta berpartisipasi dalam diskusi.

Kinerja ini tidak terlepas dari peran instruktur dalam mengatur dan mendorong kerjasama pembelajar selama penyelidikan. Pembelajar telah mendesain ruang kolaborasi bagi pembelajar untuk membuat pengalaman dan ide mereka sendiri, yang pada akhirnya mengatur kebutuhan perancah yang lebih terarah untuk membahas tantangan yang dialami pembelajar dan mengarahkan pembelajar kearah tertentu dalam fase dengan struktur. Bantuan pembelajar seperti menyediakan struktur dan ruang dalam fase penyelidikan kolaboratif dapat meningkatkan kemauan pembelajar untuk berkolaborasi. Dalam arti yang lebih luas peran pembelajar dalam pembelajaran kolaboratif inkuiri sangat penting.

Pembelajar dapat membimbing pembelajar menuju keterbukaan pikiran dan kepercayaan diri dalam menghadapi perbedaan, bahkan terkadang pertentangan opini. Misalnya ketika seorang pembelajar agak terlalu bersemangat dalam menyakral pendapat teman sekelasnya, menghasilkan suasana kelompok yang tegang, dengan demikian membutuhkan peran pembelajar untuk memecahkan suasana, meminimalisir ketegangan dan mendorong kelompok untuk melanjutkan diskusi. Selanjutnya ketika pembelajar mengakui komentar informatif satu pembelajar dengan nada setuju, pembelajar lain termotivasi untuk menyumbangkan respon yang bijaksana untuk mendapatkan perlakuan yang serupa.

Di sisi lain, meskipun diajarkan menggunakan metode konservatif dan berpusat pada pembelajar, pembelajar di kelas kontrol memiliki sikap pesimistis. Ini

bisa terjadi karena kelas besar mengurangi keterlibatan pebelajar dalam proses belajar. Peneliti menganggap bahwa pengajaran yang berfokus pada pembelajar kurang berhasil karena minim interaksi baik antar pebelajar dengan pebelajar maupun antar pebelajar dengan pembelajar serta antar pebelajar dengan lingkungan sekitar. Lingkungan pembelajaran konvensional kurang memberikan kesempatan kepada pebelajar untuk berbagi, mengkritik atau mengulas argumen. Lent & Brown (2006), berargumen bahwa sikap dengan pandangan perilaku kognitif, afektif dan individu yang diorganisir melalui pengalaman sebelumnya membentuk perspektif seseorang tentang masalah tertentu. Ini berarti bahwa sikap terkait dengan pengalaman baik kepada pebelajar, apakah mereka merasa aktifitas penyelidikan menarik atau tidak dan seberapa banyak kegiatan yang dapat mereka lakukan (Baseya & Francis, 2011). Ketika pebelajar tidak menikmati pembelajaran, mereka cenderung negatif, akhirnya mempengaruhi kinerja akademik mereka. Oleh karena itu, dapat dinyatakan bahwa lingkungan belajar menentukan sikap pebelajar di kedua kelompok.

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Instructional Strategy for Critical Thinking Disposition: Preparing Prospective Elementary Teachers in the Twenty-first Century

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Abstract

Applying active learning to promote students' critical thinking disposition is one of a current educational goal. However, it is very rare to find the research that explores the critical thinking disposition, particularly for the students who are prospective elementary school science teachers. This study aims to investigate the effects of collaborative inquiry learning on the critical thinking disposition. A quasi-experimental design with a pre-test/post-test control group was used. The total of 149 students of primary school teacher education programs participated in this study. They were divided into two groups, namely the experimental group who received treatment with the collaborative inquiry learning strategy (experiment) and the control group received treatment with the conventional strategy. The critical thinking disposition data were obtained through the critical thinking disposition inventory test and analyzed by using paired t test. The findings of this study indicate that the students in the experimental class who were exposed to collaborative inquiry learning obtained higher critical thinking disposition scores than the students in the control class. The findings of this study reveal that collaborative inquiry learning can be an effective strategy to improve critical thinking disposition.

Keywords

Collaborative Inquiry Learning, Critical Thinking Disposition, Prospective Science Teachers

Introduction

Nowadays, collaboration and critical thinking have been recognized as the 21st century skills. Almost all countries have included these two skills as the determining factor for educational success (Ahonen & Kinnunen, 2015; van Laar et al., 2020). In Indonesia, a competency-based curriculum has long been introduced by the Ministry of Education and Culture, with an emphasis on the character building and scientific attitudes such as logical, creative and innovative thinking. However, the facts show that in the college graduates, collaboration and critical thinking are found to be very limited, including the student teacher candidates who are prepared to teach in the future (Brevik et al., 2018; Irwanto, 2018; Straková & Cimermanová, 2018). At the same time, these attitudes and skills are necessary in the field of work.

This problematic dichotomy presents the need to better understand how collaboration and critical thinking are taught especially to aspiring primary school teachers who are ready to teach their students in the future. Facione (2000) recommends that critical thinking can be improved through developing the critical thinking disposition. Students who have the awareness and attitude to think critically have the opportunity to hone the critical thinking skill.

Many studies have focused on efforts to improve the critical thinking skill through the application of learning strategies (Erdogan, 2019; Mahanal et al., 2019; Saputra et al., 2019; Yasin et al., 2019). However, only a few studies focus on efforts to improve the critical thinking disposition, such as Ahmad's research (2019) which

applies the Problem-Based Learning approach to determine students' critical thinking disposition (Ahmad et al., 2019). Another study by Arzal (2017) uses an inquiry-based learning approach for critical thinking disposition in mathematics class students (Arzal, 2017). Dehghanzadeh & Fateme Jafaraghaie (2018) compared the effect of traditional learning with the flipped classroom approach on the critical thinking skill and disposition for nursing students. This study focuses on the efforts to improve the critical thinking disposition of science teacher candidates through the application of a collaborative inquiry approach. As far as our knowledge, there has been no study that applies a collaborative inquiry approach to promote the critical thinking disposition of elementary school teacher candidates.

Research shows that there is a significant relationship between learning activities for prospective teachers and teaching activities in the schools (de Vries et al., 2014; Desimone et al., 2002; Stokking et al., 2003). The prospective teacher students who are involved in active learning activities will inspire them to apply it in school (Agyei & Voogt, 2014; Desimone et al., 2002; Schwarz et al., 2009). It indicates that teachers need to instill a positive attitude towards the critical thinking. They must first be aware of their critical thinking disposition and take responsibility for their students' work and critical thinking skill. Teachers who do not have the critical thinking disposition automatically do not have the ability to teach the critical thinking disposition to their students (Mohamad et al., 2015). This statement is supported by (Abrami et al., 2008; Facione, 2000; Unlu, 2018) who argue that the best way to improve the skill and critical thinking disposition is to apply them explicitly through the academic activities such as training and faculty development.

This is considered necessary to be investigated, given the scarcity of literature on the critical thinking tendencies of elementary school teacher candidates. Thus, to fill the gaps in the literature, this study aims to determine the critical thinking disposition of elementary school teacher candidates by implementing inquiry collaborative learning strategies.

Collaborative learning is not only learning and working in groups with the teacher instructions; however, it is a process by which two or more people interact to activate their cognition (Dillenbourg, 1999). In collaborating, students must engage together, recognize the differences in knowledge, unite the perceptions, and find the solutions. The individual success in collaboration based on the joining intellectual activities and efforts (Laal & Laal, 2012; Lou & Kim MacGregor, 2004). Many researchers have focused on collaborative learning. This is influenced by the characteristics of collaborative learning that emphasize the social interaction, intellectual engagement, and shared responsibility. The term collaborative inquiry is a sub-category of collaborative learning and inquiry. The word inquiry comes from the word to inquiry which means the involvement in asking questions, seeking information, and conducting investigations. It is a collaborative approach to solving problems in a reflective and interactive way where the individuals construct meaning and together confirm the understanding (Garrison, 2016). Combining the collaborative learning with inquiry learning can enhance the performance leading to the development of new knowledge (Okada & Simon, 1997; Springer et al., 1999b; van Boxtel et al., 2000). There is a very important relationship between inquiry collaborative learning and critical thinking disposition. Both are based on the students' willingness to take the responsibility and have the ability to construct the meaning and validate the information. The disposition of critical thinking is the spirit of the soul and self-motivation to be active and systematically involved in the problem verification, understanding the problems, looking for and considering the evidence, and evaluating. In the context of learning, the word disposition leads to self-regulation and active involvement in truth seeking while the term of critical thinking contributes to the students' ability to examine, evaluate, criticize, and promote the concepts based on valid facts. The critical thinking disposition is needed to lead elementary school teacher candidates to think critically. This is not only for their personal needs but it also for their future generations. This can be achieved if they are trained to be involved together in planning, designing and conducting the investigations. Therefore, this study aims to investigate the effect of collaborative inquiry learning on critical thinking disposition of elementary school science teacher candidate students. The research questions are:

RQ1: Is there any significant difference between the pre-test and post-test scores of the experimental group in terms of critical thinking disposition?

RQ2: Is there any significant difference between the control group's pre-test and post-test scores in terms of critical thinking disposition?

RQ3: Is there any significant difference between the post-test scores of the experimental group and the control group in terms of critical thinking disposition?

Literature Review

Critical Thinking (CT) and Disposition of Critical Thinking (CTD)

Critical thinking is an individual asset to understand and solve problems holistically. Ideally, a person is considered as a critical thinker if he is able to utilize the intellectual intelligence to think or act in a reflective and reasonable manner (Ennis, 1991; Ahrari, Samah, Hassan, Wahat & Zaremohzzabieh, 2016; Beavers, Orange & Kirkwood, 2017). This includes two dimensions of thinking, namely the cognitive dimension (critical thinking skill) and the disposition dimension (critical thinking disposition). The cognitive dimension deals with the process of reasoning, problem solving and decision making based on the evidence and/or values. The disposition dimension relates to the motivation or enthusiasm for critical thinking. These two dimensions need each other; critical thinking skills can be improved through the encouragement of internal motivation (critical thinking disposition). Conversely, to foster the critical thinking disposition requires the critical spirit. The term of critical spirit refers to the characteristics of individuals who often make use of critical thinking skill.

The critical thinking skill is needed in the field of work so that it attract a lot of attention from researchers to investigate it. The researchers and educators have found that there is other dimension within individuals that is able to foster the critical thinking skill, namely the disposition dimension. This finding diverts the attention of the researchers to improve the critical thinking disposition, including student teacher candidates who are ready to teach their students in the future. Research conducted by Demirhan & Köklükaya (2014) shows that science teacher candidates have the ability to think critically at the middle and low levels. The results of this study recommend that there is a need for models, strategies, approaches and methods to improve the critical thinking skill of science teacher candidates. The results of this study are in line with previous research conducted by (Kezer & Turker, 2012), related to the critical thinking disposition of science teacher candidates in Turkey. Research conducted by (Arsal, 2017) concerning the effect of inquiry learning towards the critical thinking disposition of prospective teachers using the quasi-experimental method shows that there is no significant effect between inquiry-based learning and teacher candidate critical thinking disposition, even though there is an increase in critical thinking disposition. This result contradicts several previous studies such as (Kwan & Wong, 2015) which found that inquiry-based learning positively affects the critical thinking disposition of prospective teachers. Therefore, we suspect that critical thinking disposition can be improved by providing opportunities for students to plan and conduct investigations in groups through a collaborative inquiry learning approach.

Collaborative Inquiry Learning

Collaborative learning is not only learning and working in groups by the teacher instruction but it is a process by which two or more people interact to activate their cognition (Dillenbourg, 1999). In collaborating, students must engage together, recognize the differences in knowledge, unite the perceptions, and find the solutions. Individual success in collaboration based on the joining intellectual activities and efforts (Laal & Laal, 2012; Lou & Kim MacGregor, 2004).

In the current era where the collaborative learning is found to be more prominent, many pedagogical researchers are focusing on the collaborative learning. This is influenced by the characteristics of collaborative learning that emphasize the social interaction, intellectual involvement, and shared responsibility - along with the development of the term collaborative education research, which is then combined with several learning methods, for example inquiry learning collaborative. The term of collaborative inquiry is a sub-category of collaborative learning and inquiry. The word inquiry comes from the word inquiry, which means involvement in asking questions, seeking information, and conducting investigations. Investigation is a collaborative approach to solving the problems in a reflective and interactive way in which individuals construct the meaning and together confirm the understanding (Garrison, 2016).

Combining the collaborative learning with the inquiry learning can improve the performance which leads to the development of new knowledge (Okada & Simon, 1997; Springer et al., 1999b; van Boxtel et al., 2000). When students collaborate, they can exchange ideas, ask questions, provide explanations, and negotiate. In carrying out the collaborative inquiry learning, learning requires preparation from students. The role of the teacher is as active as the role of students, and the teacher must be active in fulfilling the student needs. As long as the activities of collaborative inquiry such as lesson plan create the collaboration situation, encouragement, and motivation is the main task of the students (Urhahne et al., 2010). The students who design the learning before teaching can contribute to the student understanding (van Uum et al., 2017). They must ensure that the learning environment including media and learning resources is according to the inquiry activities. They also need to master all of the devices or the materials used include the tools, teaching materials, and learning steps.

Hypotheses Development

There are three hypotheses proposed in this study as follows:

Hypothesis 1: There is a significant difference between the experimental group's pre-test and post-test scores in terms of critical thinking disposition.

Hypothesis 2: There is a significant difference between the control group's pre-test and post-test scores in terms of critical thinking disposition?

Hypothesis 3: There is a significant difference between the post test scores of the experimental group and the control group in terms of critical thinking disposition?

Research Method

Research Design

Quasi-experimental with pre-test / post-test control group design was used in this study. Four parallel classes were given intervention for 12 weeks from August to November 2019. Two parallel classes as the experimental groups were taught by collaborative inquiry learning. Meanwhile, the other two classes as the control group were taught using conventional inquiry. The inquiry and conventional collaborative learning were as the independent variables while the critical thinking disposition was as the dependent variable. The critical thinking disposition instrument was adapted to assess the critical thinking disposition of elementary school science teacher candidate students before and after the intervention.

Population and Sample

This study involved 149 students of the Elementary School Teacher Education program at Khairun University, Ternate, Indonesia. They are first year students who are taking the basic science courses. They were divided into two groups, namely the experimental group (N = 74) and the control group (N = 75). This division is based on data which obtained through the personal identity form and the pre-test score of critical thinking disposition. The results of the t-test sample of the independent sample of pre-test data showed that these two groups had the same critical thinking disposition ($t(149) = -0.528; p > 0.05$).

Data Collecting Instrument

In measuring critical thinking dispositions, an assessment instrument is used in the form of a questionnaire with a multilevel scale. The instrument was arranged in the form of a statement with a total of 45 items. The questionnaire statement originated from the seven habits of thought put forward by Facione, namely truth-seeking, open-mindedness, analytics, systematic curiosity, self-

confidence and maturity. The instrument was arranged using a Likert scale (1 = "strongly disagree; 2 = disagree; 3). This instrument was developed by adapting from instruments that have been developed by Sosu (2013) and Shin, Park & Kim, (2015) but adapted or adjusted in the context of collaborative inquiry learning for student teacher candidates. This is because Sosu (2013) and Shin, Park & Kim (2005) focus more on critical thinking disposition in general. The research instrument can be seen in Table 1.

Table 1
List of statements/questions used to measure critical thinking disposition Sosu (2013) and Shin, Park & Kim (2005)

No.	Questions/Statements
1	I think of quality ideas when discussing
2	I rarely think of new ideas in solving problems
3	I use more than one source to find information
4	I immediately accept other people's ideas without considering them
5	I like intellectually challenging things
6	I justify the choices that I make even without evidence
7	I try to understand how investigation works
8	I avoid negative things that affect my mind
9	I think that any opinion does not need any reason or evidence
10	I often think about my actions to see if I can fix them
11	I wisely take the decisions
12	I solve the problem based on systematically managed data
13	I lack of confidence in solving the problem
14	I am considering several alternatives to solve the problem
15	I defend the truth based on the evidence
16	I give reasons if I disagree with other people's opinions
17	I use appropriate reasons in taking the decisions
18	I often think about my actions to see if I can fix them
19	I immediately answer questions / solve problems before examining them first
20	I look for solutions based on various aspects
21	I am active in thinking
22	I express doubts about other people's ideas in a wise way
23	It bothers me a lot if I can't solve a problem
24	I usually check the source of information before making any judgments
25	I stick to my idea even though I don't have good reasons
26	I look for new ideas from various points of view
27	I feel it is important to justify the choices I make

28	I doubt the answers / ideas that I convey despite the evidence
29	I believe I can get through the tough problems
30	I feel it is not important to review what I have done
31	I turn my mistakes into opportunities to continue learning
32	I am quick in making the decisions without the support evidence
33	I am willing to accept the truth with the support evidence
34	I defend my own interests without considering the interests of others
35	I accept the different views
36	I reflect on and acknowledge other people's ideas
37	I justify the choices that I make even without evidence
38	I work based on the defined procedures / steps
39	I make my conclusions based on evidence
40	I think of difficult things so I forget things that are easy to do
41	I think of the answers to specific things
42	I reevaluate my experience so that I can learn from it
43	I am willing to accept the criticism of my opinion
44	I have my own way in solving the problems
45	I believe the ideas that I express can provide solutions

Procedures

This research begins with a focus group discussion (FGD) between lecturers, researchers and observers. FGD was conducted to ensure that all equipment, tools and media as well as supporting facilities had been prepared. The timing of the research and the division of tasks for the research team was also agreed upon during the FGD activities. After conducting the FGD, the researcher then contacted the students and took the initial action, namely making an agreement through filling out the study contract form, filling in the personal data instruments including name, place of birth date, gender, origin and so on. Furthermore, participants from the experimental group and the control group were given brief training on the procedures and steps of inquiry collaborative learning. The researcher also provides an explanation of the principles of teamwork.

The research process was set at an odd semester of 16 meetings, starting from the pre-test stage, the treatment stage until the post-test stage. The pre-test activity was carried out the first week by distributing a critical thinking disposition questionnaire to students one week before the treatment was carried out. Then, the treatment stage was carried out in the experimental group and the control group. At the first meeting, the teacher provided reinforcement of scientific method steps to strengthen the inquiry skills. A 14-weeks recovery session with a total of 340 lesson hours was conducted face-to-face, non-face-to-face, and field or laboratory investigation. Inquiry collaborative learning activities were designed to involve students in learning the concepts, designing investigations, carrying out the investigations in the laboratory or in an open environment and making the reports in groups. Each group member was given the time to prepare each unit of investigation activity by studying the information before lectures begin at the next meeting. The initial conceptual knowledge of each group member was used as material for group discussion in

designing and conducting the investigation. The researcher designed the intervention and provided the instructor with all the necessary materials.

In this study, the collaborative inquiry learning steps were adapted from several sources such as Cash, Dekonick, & Ahmed-Kristenen, 2017, Khine & Saleh (2010) dan Padaste et al (2015). There are five phases of collaborative inquiry learning, namely the orientation phase, conceptualization, investigation, conclusion and discussion. The orientation phase is a process to identify and encourage students' curiosity about the topics being taught. In this phase, the instructor divides students into small groups heterogeneously, gives investigative tasks, and delivers instructions. They work in groups, share assignments, brainstorm, determine problems to solve and set common goals. Furthermore, in the conceptualization phase students discuss in groups to formulate the problems or questions and formulate hypotheses based on theory. This process is carried out by sharing common understanding of topics through communication and social interaction. The team members from each group describe the context of the investigation and their ideas to improve and develop the design plan. This process is called the investigative phase which briefly begins with the exploration activities, continues with experiments and ends with interpretation.

After the investigation phase, the next phase is the process of making the conclusions based on the data and comparing the conclusions based on the data with hypotheses or research questions. The findings are presented in the form of a report which will be discussed with other groups in the discussion phase.

Results and Discussion

Data Analysis

The Kolmogorov-Smirnov normality test was carried out for the first time in data analysis to test the normal distribution of the data. The test was continued with the variance homogeneity test using Levene to test the homogeneity of variance between groups. Based on the results of the normality test and the homogeneity test of variance, it will be determined whether the parametric test can be used or not. Parametric testing used paired t-test to compare the pre-test and post-test, then the independent t-test to compare between the groups.

Table 2
The Result of Normality Test with Kolmogorov-Smirnov

Component			K-S	P
Anlicity	Pre-test	Experimental	0.095	0.094
		Control	0.097	0.079
	Post-test	Experimental	0.085	0.200
		Control	0.094	0.095
CT-Self Confidence	Pre-test	Experimental	0.100	0.064
		Control	0.085	0.200
	Post-test	Experimental	0.091	0.200
		Control	0.088	0.200
Mature Judgement	Pre-test	Experimental	0.098	0.076
		Control	0.090	0.200
	Post-test	Experimental	0.096	0.090
		Control	0.093	0.171
Inquisitiveness	Pre-test	Experimental	0.091	0.200
		Control	0.094	0.098
	Post-test	Experimental	0.096	0.089

Open-mindedness	Pre-test	Control	0.081	0.200
		Experimental	0.094	0.176
	Post-test	Control	0.097	0.075
		Experimental	0.091	0.200
Systematicity	Pre-test	Control	0.091	0.199
		Experimental	0.097	0.079
	Post-test	Control	0.100	0.065
		Experimental	0.100	0.061
Truth-seeking	Pre-test	Control	0.087	0.200
		Experimental	0.092	0.184
	Post-test	Control	0.083	0.200
		Experimental	0.091	0.198
Total	Pre-test	Control	0.094	0.168
		Experimental	0.094	0.168
	Post-test	Control	0.090	0.200
		Experimental	0.090	0.200

The result of the Kolmogorov-Smirnov normality test in Table 2 shows that the data used is normally distributed ($p > 0.05$) for all components of critical thinking disposition in each tested group, both on the pre-test and post-test scores. Table 2 presents the result of the Levene test on the pre-test and post-test scores obtained by the experimental and control groups from CTD.

Table 3
The Result of Variance Homogeneity Test with Levene

Component		F	df1	df2	P
Anlicity	Pre-test	0.001	1	147	0.973
	Post-test	3.522	1	147	0.063
CT-Self Confidence	Pre-test	1.035	1	147	0.311
	Post-test	0.385	1	147	0.536
Mature Judgement	Pre-test	0.066	1	147	0.797
	Post-test	0.354	1	147	0.553
Inquisitiveness	Pre-test	0.156	1	147	0.693
	Post-test	0.007	1	147	0.932
Open-mindedness	Pre-test	0.166	1	147	0.684
	Post-test	3.463	1	147	0.065
Systematicity	Pre-test	2.640	1	147	0.106
	Post-test	1.349	1	147	0.247
Truth-seeking	Pre-test	1.778	1	147	0.184
	Post-test	3.491	1	147	0.064
Total	Pre-test	2.766	1	147	0.098
	Post-test	3.492	1	147	0.064

As shown in Table 3, the variance in the pre-test and post-test scores of the experimental and control groups of the total CTD component shows homogeneous data. In general, the results of the Kolmogorof-Smirnov goodness of fit and the Levene test reveal that the parametric test can be used to analyze data obtained from research. Table 3 presents the result of the independent sample t-test on the pre-test scores of the experimental and control groups of CTD.

The comparison result of the pre-test scores between the experimental group and the control group in Table 4 shows that there are no significant differences between all components tested ($df=147$; $p<0.05$).

Table 4
The Independent t-test Result on the Pre-test Scores between the Experimental Group dan Control Group

Component		N	M	SD	t
Anlitivity	Experimental	74	2.498	0.377	1.386
	Control	75	2.413	0.366	
CT-Self Confidence	Experimental	74	2.703	0.370	0.680
	Control	75	2.658	0.431	
Mature Judgement	Experimental	74	2.270	0.355	0.472
	Control	75	2.242	0.373	
Inquisitiveness	Experimental	74	2.516	0.406	-0.225
	Control	75	2.531	0.428	
Open-mindedness	Experimental	74	2.541	0.441	-1.039
	Control	75	2.618	0.466	
Systematicity	Experimental	74	2.523	0.363	-1.572
	Control	75	2.627	0.440	
Truth-seeking	Experimental	74	2.511	0.455	-1.525
	Control	75	2.617	0.393	
Total	Experimental	74	2.509	0.214	-0.528
	Control	75	2.529	0.241	

* $p<0.05$

The comparison of the pre-test and post-test scores in the experimental group in Table 5 shows that there are significant differences in all components tested ($df=73$; $p<0.05$).

Table 5
The Results of Paired t-test on the Pre-test and Post-test Values in the Experimental Group

Component		N	M	SD	t
Anlitivity	Pre-test	74	2.498	0.377	-14.105
	Post-test	74	3.329	0.437	
CT-Self Confidence	Pre-test	74	2.703	0.370	-10.504
	Post-test	74	3.387	0.450	
Mature Judgement	Pre-test	74	2.270	0.355	-18.723
	Post-test	74	3.421	0.439	
Inquisitiveness	Pre-test	74	2.516	0.406	-13.880
	Post-test	74	3.547	0.450	
Open-mindedness	Pre-test	74	2.541	0.441	-14.847

	Post-test	74	3.504	0.442	
Systematicity	Pre-test	74	2.527	0.367	-13.798
	Post-test	74	3.493	0.492	
Truth-seeking	Pre-test	74	2.511	0.455	-14.230
	Post-test	74	3.509	0.461	
Total	Pre-test	74	2.509	0.214	-21.146
	Post-test	74	3.456	0.338	

* p<0.05

The comparison result of the pre-test and post-test scores in the control group in Table 6 shows that there are significant differences in all components tested. The post-test mean score which was higher than the pre-test mean score indicated that the treatment carried out in the control group had a significant effect on the increase in the value of each component.

Table 6
The Paired t-test Result on Pre-test dan Post-test Scores in the Control Group

Component		N	M	SD	t
Anlitivity	Pre-test	75	2.413	0.366	-14.668
	Post-test	75	3.151	0.355	
CT-Self Confidence	Pre-test	75	2.658	0.431	-9.077
	Post-test	75	3.124	0.426	
Mature Judgement	Pre-test	75	2.242	0.373	-16.181
	Post-test	75	3.211	0.489	
Inquisitiveness	Pre-test	75	2.531	0.428	-13.763
	Post-test	75	3.353	0.451	
Open-mindedness	Pre-test	75	2.618	0.466	-12.458
	Post-test	75	3.316	0.361	
Systematicity	Pre-test	75	2.627	0.440	-11.893
	Post-test	75	3.324	0.426	
Truth-seeking	Pre-test	75	2.618	0.393	-15.044
	Post-test	75	3.356	0.372	
Total	Pre-test	75	2.529	0.241	-25.480
	Post-test	75	3.263	0.271	

* p<0.05

The results of the comparison of post-test scores between the experimental group and the control group in Table 7 show that there are significant differences in all components tested. The average value of the experimental group which is higher than the average value of the control group indicates that the treatment carried out in the experimental group has a better effect on increasing the value of each component.

Table 7
The results of the Independent t-test on the Post-test Scores between the Experiment Group and the Control Group

Component		N	M	SD	t
Anlicity	Experimental	74	3.329	0.437	2.722
	Control	75	3.151	0.355	
CT-Self Confidence	Experimental	74	3.387	0.450	3.665
	Control	75	3.124	0.426	
Mature Judgement	Experimental	74	3.421	0.439	2.760
	Control	75	3.211	0.489	
Inquisitiveness	Experimental	74	3.547	0.450	2.629
	Control	75	3.353	0.451	
Open-mindedness	Experimental	74	3.504	0.442	2.858
	Control	75	3.316	0.361	
Systematicity	Experimental	74	3.493	0.492	2.242
	Control	75	3.324	0.426	
Truth-seeking	Experimental	74	3.509	0.461	2.237
	Control	75	3.355	0.372	
Total	Experimental	74	3.456	0.338	3.857
	Control	75	3.263	0.271	

* $p < 0.05$

Theoretical Implication

This study reveals the results that in basic science courses, collaborative inquiry learning has a significant impact on the achievement of students' critical thinking dispositions. The collaborative inquiry learning approach makes students' critical thinking dispositions more accessible than conventional approaches. This may be triggered by the collective involvement of learners in the meeting common goals. As a pedagogic approach, collaborative inquiry emphasizes the constructivist paradigm, in which learners obtain the new information from their peers and encourage the recall of knowledge and subject matter so as to contribute to the academic performance and more effective learning attitudes (Cooper, 2006). Several studies suggest that collaborative learning combined with the investigative and problem-solving activities contributes to the cognitive and affective learning outcomes (Sukmawati, Setyosari, Sulton, & Purnomo (2019); Pramusinta, Setyosari, Widiawati, & Kuswandi (2019). s

In the collaborative inquiry learning strategy, the learners engage collectively in exploring the material with their peers, acquire the new knowledge, compare their opinions with peers, evaluate the various perspectives and improve their problem-solving skills. This involvement encourages the students to develop analytical attitudes and teamwork, thereby enhancing their ability to think critically. This is consistent with Piaget (1928) and in line with Fung (2017) research. Piaget (1928) showed that cognitive dissonance, which is usually caused by peer social interactions, plays an important role in the cultivation of cognitive growth and amplifies the effects of learning. In this sense, the collaborative group work can be thought of as peer to peer interactions that promote the

decision-making and shared the responsibility through the cognitive conflict. Fung (2017) proves that collaborative learning environments can help the learners in developing new ideas by emphasizing the important role of arguments in stimulating the critical thinking disposition.

In addition, Cheng & Wan (2017) also argued that the active involvement of learners in the exchange of contextual ideas to plan, design and conduct experiments can have a positive impact on the critical thinking attitudes. This practice reflects the application of constructivist theory, in which learners independently engage in collective work and experimental studies to acquire high-level abilities.

The results of the data analysis confirmed that the post-test mean score was higher than the pre-test mean score, indicates that the treatment carried out in the experimental group had a significant effect on the increase in the value of each component. The total average pre-test and post-test scores obtained from the experimental group $t(74) = 0.000; p < 0.05$. The total post-test mean score of the experimental group ($M = 3.456, SD = 0.338$) was found higher than the pre-test average score ($M = 2.509; SD = 0.214$). These findings indicate that the science course carried out with collaborative inquiry is effective in increasing the critical thinking disposition of science teacher candidate students. The results of data analysis also show that there are differences in critical thinking dispositions between students involved in collaborative inquiry strategies and conventional strategies.

On the other hand, although the average score for the seven components of critical thinking disposition was not much different in the experimental group, the inquisitiveness component obtained an average score higher than the other components while the lowest was the analyticity component. The high of inquisitiveness component is because the students are enthusiastic about designing their investigative activities, they intensely ask questions and discuss. Conversely, the analyticity component was lower than the other components because the students were less encouraged to develop arguments based on the evidence.

Practical Implication

Inquiry collaborative learning helps the learners to solve the problems while developing awareness and increasing their success through experiences ultimately contributing to a productive mindset. During the inquiry exercise, the learners' awareness will be increased as they are directly involved in developing content, finding problems, designing investigations, and finding answers. Students in the collaborative inquiry learning strategy group engaged in collaborative inquiry are very interested in creating and building the arguments. They seek to find the evidence of their friends' opinions by sharing claims and input the statements and participating in the discussions.

This performance is inseparable from the instructor's role in regulating and encouraging the learners' cooperation during the investigation. The learners have designed the collaborative spaces for them to create their own experiences and ideas, which ultimately regulates the need for a more targeted scaffold to address challenges that experienced by the learners and direct them in specific directions in a phase with the structure. Learner assistance such as providing structure and space in the collaborative inquiry phase can increase learners' willingness to collaborate. In a broader sense, the learner's role in inquiry collaborative learning is very important.

Learners can guide the students towards open-mindedness and self-confidence in the face of differences, sometimes even conflicting opinions. For example, when a student is a bit too enthusiastic in denying the opinion of his classmate, it results in a tense group atmosphere, thus requiring the learner's role to break the atmosphere, minimize the tension and encourage the group to continue the discussion. Furthermore, when the learners acknowledge one student's informative comments with a tone of agreement, other students are motivated to contribute thoughtful responses to get the similar treatment.

On the other hand, although taught using conservative and learner-centered methods, students in the control class had a pessimistic attitude. This can happen because large classes reduce the involvement of learners in the learning process. Researcher considers that the students-focused teaching is less successful because of the minimal interaction between student and student and

between learner and students and also between students and the surrounding environment. The conventional learning environment does not provide opportunities for students to share, criticize or review the arguments. Many researchers argued that attitudes with views of cognitive, affective and individual behavior organized through previous experiences shape one's perspective on a particular problem. This means that attitudes are related to good experiences for students, whether they find the investigative activity interesting or not and how much activity they can do (Baseya & Francis, 2011). When students do not enjoy learning, they tend to negatively affect their academic performance. Therefore, it can be stated that the learning environment determines the students' attitudes in both groups.

Conclusion

Collaborative learning integrated with inquiry can encourage prospective elementary school teacher students to hone scientific skills such as critical thinking, collaborative thinking and problem solving. This also has an impact on developing the critical thinking dispositions and improving the quality of primary school teacher education. The results of the study prove that the collaborative inquiry learning strategy is effective in increasing the critical thinking disposition than the conventional learning. Thus, the contribution of this study is to fostering teacher candidates who are ready to teach their students to think critically. Given the educational needs of primary school teachers, adopting a collaborative inquiry strategy can have a central role in developing analytical, systematic, transparency, maturation and open skills. The limitation of this study is using small sample size, so it will be a consideration to generalize the results. Besides, this study only focus on elementary school teacher. Future research can be carried out by including larger sample size and also applying the research regarding the collaborative inquiry learning to the other school such as secondary school or high school. Furthermore, it is necessary to study the utilization of computer technology to assist online collaborative inquiry learning activities to guide prospective teacher students towards longlife learners.

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Summary of Reviewer's Comments

❖ **Recommendation to Editor** (Please mark “x” for appropriate option)

- (x) Excellent, accept the submission (5)
- () Good, accept the submission with minor revisions required (4)
- () Acceptable, revisions required (3)
- () Resubmit for review, major revisions required (2)
- () Decline the submission (1)

The editor will forward the section below to author/s

Evaluation (Please assign the score for each item below)

5=Excellent 4=Good 3=Average 2=Below Average 1=Poor n/a=Not Applicable

Items	Grade
Overall evaluation on the paper	
1. Contribution to existing knowledge	4
2. Appropriate formatting and structure	4.0
3. Readability	3.0
4. Soundness of methodology	4.5
5. Evidence supports conclusion	4.5
6. Adequacy of literature review	4.5

❖ **Strengths**

The paper entitled “**INSTRUCTIONAL STRATEGY FOR CRITICAL THINKING DISPOSITION: PREPARING PROSPECTIVE ELEMENTARY TEACHERS IN THE TWENTY-FIRST CENTURY**” is received for review; it is very rare to find the research that explores the critical thinking disposition, particularly for the students who are prospective elementary school science teachers, thus this study contributes to the literature and in my view the above title is suitable for publication in RIGEO.

❖ **Weaknesses**

- In my view the background needs restructuring to highlight the objective of the study.
- Please provide paper structure also before the research questions.
- Please provide references where necessary.
- There are erroneous sentence structures which are required to be revised
- Please discuss the limitations of your study.
- Please provide implications of the study
- Formatting of the document is required
- Proofreading is required
- The references are required to be updated in accordance with the literature

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With Warm Regards,
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Instructional Strategy for Critical Thinking Disposition: Preparing Prospective Elementary Teachers in the Twenty-first Century

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Abstract

Applying active learning to promote students' critical thinking disposition is one of a current educational goal. However, it is very rare to find the research that explores the critical thinking disposition, particularly for the students who are prospective elementary school science teachers. This study aims to investigate the effects of collaborative inquiry learning on the critical thinking disposition. A quasi-experimental design with a pre-test/post-test control group was used. The total of 149 students of primary school teacher education programs participated in this study. They were divided into two groups, namely the experimental group who received treatment with the collaborative inquiry learning strategy (experiment) and the control group received treatment with the conventional strategy. The critical thinking disposition data were obtained through the critical thinking disposition inventory test and analyzed by using paired t test. The findings of this study indicate that the students in the experimental class who were exposed to collaborative inquiry learning obtained higher critical thinking disposition scores than the students in the control class. The findings of this study reveal that collaborative inquiry learning can be an effective strategy to improve critical thinking disposition.

Keywords

Collaborative Inquiry Learning, Critical Thinking Disposition, Prospective Science Teachers

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Introduction

Nowadays, collaboration and critical thinking have been recognized as the 21st century skills. Almost all countries have included these two skills as the determining factor for educational success (Ahonen & Kinnunen, 2015; van Laar, van Deursen, van Dijk, & de Haan, 2020). In Indonesia, a competency-based curriculum has long been introduced by the Ministry of Education and Culture, with an emphasis on the character building and scientific attitudes such as logical, creative and innovative thinking. However, the facts show that in the college graduates, collaboration and critical thinking are found to be very limited, including the student teacher candidates who are prepared to teach in the future (Brevik, Gunnulfsen, & Renzulli, 2018; Irwanto, Rohaeti, & Prodjosantoso, 2018; Straková & Cimermanová, 2018). At the same time, these attitudes and skills are necessary in the field of work.

This problematic dichotomy presents the need to better understand how collaboration and critical thinking are taught especially to aspiring primary school teachers who are ready to teach their students in the future. Facione (2000) recommends that critical thinking can be improved through developing the critical thinking disposition. Students who have the awareness and attitude to think critically have the opportunity to hone the critical thinking skill.

Many studies have focused on efforts to improve the critical thinking skill through the application of learning strategies (Erdogan, 2019; Mahanal, Zubaidah, Sumiati, Sari et al., 2019; Saputra, Joyoatmojo, Wardani, & Sangka, 2019; YASIN, JAUHARIYAH, MADIYO, RAHMAWATI et al., 2019). However, only a few studies focus on efforts to improve the critical thinking disposition, such as Owen (2019) research which applies the Problem-Based Learning approach to determine students' critical thinking disposition. Another study by Arsal (2017) uses an inquiry-based learning approach for critical thinking disposition in mathematics class students. Dehghanzadeh, Jafaraghaie, and Khordadi Astane (2018) compared the effect of traditional learning with the flipped classroom approach on the critical thinking skill and disposition for nursing students. This study focuses on the efforts to improve the critical thinking disposition of science teacher candidates through the application of a collaborative inquiry approach. As far as our knowledge, there has been no study that applies a collaborative inquiry approach to promote the critical thinking disposition of elementary school teacher candidates.

Research shows that there is a significant relationship between learning activities for prospective teachers and teaching activities in the schools (de Vries, Jansen, Helms-Lorenz, & van de Griff, 2014; Desimone, Porter, Garet, Yoon et al., 2002; Stokking, Leenders, De Jong, & Van Tartwijk, 2003). The prospective teacher students who are involved in active learning activities will inspire them to apply it in school (Agyei & Voogt, 2014; Desimone et al., 2002; Schwarz, Reiser, Davis, Kenyon et al., 2009). It indicates that teachers need to instill a positive attitude towards the critical thinking. They must first be aware of their critical thinking disposition and take responsibility for their students' work and critical thinking skill. Teachers who do not have the critical thinking disposition automatically do not have the ability to teach the critical thinking disposition to their students (Mohamad, Rahim, Sulaiman, & Baki, 2015). This statement is supported by Abrami, Bernard, Borokhovski, Wade et al. (2008); Facione (2000); Sahika (2018) who argue that the best way to improve the skill and critical thinking disposition is to apply them explicitly through the academic activities such as training and faculty development.

This is considered necessary to be investigated, given the scarcity of literature on the critical thinking tendencies of elementary school teacher candidates. Thus, to fill the gaps in the literature, this study aims to determine the critical thinking disposition of elementary school teacher candidates by implementing inquiry collaborative learning strategies.

Collaborative learning is not only learning and working in groups with the teacher instructions; however, it is a process by which two or more people interact to activate their cognition (Dillenbourg, 1999). In collaborating, students must engage together, recognize the differences in knowledge, unite the perceptions, and find the solutions. The individual success in collaboration based on the joining intellectual activities and efforts (Laal & Laal, 2012; Lou & Kim MacGregor, 2004). Many researchers have focused on collaborative learning. This is influenced by the characteristics of collaborative learning that emphasize the social interaction, intellectual engagement, and shared responsibility. The term collaborative inquiry is a sub-category of collaborative learning and inquiry. The word inquiry comes from the word to inquiry which means the involvement in asking questions, seeking information, and conducting investigations. It is a

collaborative approach to solving problems in a reflective and interactive way where the individuals construct meaning and together confirm the understanding (Garrison, 2015). Combining the collaborative learning with inquiry learning can enhance the performance leading to the development of new knowledge (Okada & Simon, 1997; Springer, Stanne, & Donovan, 1999; Van Boxtel, Van der Linden, & Kanselaar, 2000). There is a very important relationship between inquiry collaborative learning and critical thinking disposition. Both are based on the students' willingness to take the responsibility and have the ability to construct the meaning and validate the information. The disposition of critical thinking is the spirit of the soul and self-motivation to be active and systematically involved in the problem verification, understanding the problems, looking for and considering the evidence, and evaluating. In the context of learning, the word disposition leads to self-regulation and active involvement in truth seeking while the term of critical thinking contributes to the students' ability to examine, evaluate, criticize, and promote the concepts based on valid facts. The critical thinking disposition is needed to lead elementary school teacher candidates to think critically. This is not only for their personal needs but it also for their future generations. This can be achieved if they are trained to be involved together in planning, designing and conducting the investigations. Therefore, this study aims to investigate the effect of collaborative inquiry learning on critical thinking disposition of elementary school science teacher candidate students. The research questions are:

RQ1: Is there any significant difference between the pre-test and post-test scores of the experimental group in terms of critical thinking disposition?

RQ2: Is there any significant difference between the control group's pre-test and post-test scores in terms of critical thinking disposition?

RQ3: Is there any significant difference between the post-test scores of the experimental group and the control group in terms of critical thinking disposition?

Literature Review

Critical Thinking (CT) and Disposition of Critical Thinking (CTD)

Critical thinking is an individual asset to understand and solve problems holistically. Ideally, a person is considered as a critical thinker if he is able to utilize the intellectual intelligence to think or act in a reflective and reasonable manner (Ahrari, Samah, Hassan, Wahat et al., 2016; Beavers, Orange, & Kirkwood, 2017; Ennis, 2013). This includes two dimensions of thinking, namely the cognitive dimension (critical thinking skill) and the disposition dimension (critical thinking disposition). The cognitive dimension deals with the process of reasoning, problem solving and decision making based on the evidence and/or values. The disposition dimension relates to the motivation or enthusiasm for critical thinking. These two dimensions need each other; critical thinking skills can be improved through the encouragement of internal motivation (critical thinking disposition). Conversely, to foster the critical thinking disposition requires the critical spirit. The term of critical spirit refers to the characteristics of individuals who often make use of critical thinking skill.

The critical thinking skill is needed in the field of work so that it attract a lot of attention from researchers to investigate it. The researchers and educators have found that there is other dimension within individuals that is able to foster the critical thinking skill, namely the disposition dimension. This finding diverts the attention of the researchers to improve the critical thinking disposition, including student teacher candidates who are ready to teach their students in the future. Research conducted by Demirhan and Köklükaya (2014) shows that science teacher candidates have the ability to think critically at the middle and low levels. The results of this study recommend that there is a need for models, strategies, approaches and methods to improve the critical thinking skill of science teacher candidates. The results of this study are in line with previous research conducted by Kezer & Turker, (2012), related to the critical thinking disposition of science teacher candidates in Turkey. Research conducted by Arsal (2017) concerning the effect of inquiry learning towards the critical thinking disposition of prospective teachers using the quasi-experimental method shows that there is no significant effect between inquiry-based learning and teacher candidate critical thinking disposition, even though there is an increase in critical thinking disposition. This result contradicts several previous studies such as Desimone et al. (2002) which

found that inquiry-based learning positively affects the critical thinking disposition of prospective teachers. Therefore, we suspect that critical thinking disposition can be improved by providing opportunities for students to plan and conduct investigations in groups through a collaborative inquiry learning approach.

Collaborative Inquiry Learning

Collaborative learning is not only learning and working in groups by the teacher instruction but it is a process by which two or more people interact to activate their cognition (Dillenbourg, 1999). In collaborating, students must engage together, recognize the differences in knowledge, unite the perceptions, and find the solutions. Individual success in collaboration based on the joining intellectual activities and efforts (Laal & Laal, 2012; Lou & Kim MacGregor, 2004).

In the current era where the collaborative learning is found to be more prominent, many pedagogical researchers are focusing on the collaborative learning. This is influenced by the characteristics of collaborative learning that emphasize the social interaction, intellectual involvement, and shared responsibility - along with the development of the term collaborative education research, which is then combined with several learning methods, for example inquiry learning collaborative. The term of collaborative inquiry is a sub-category of collaborative learning and inquiry. The word inquiry comes from the word inquiry, which means involvement in asking questions, seeking information, and conducting investigations. Investigation is a collaborative approach to solving the problems in a reflective and interactive way in which individuals construct the meaning and together confirm the understanding (Garrison, 2015).

Combining the collaborative learning with the inquiry learning can improve the performance which leads to the development of new knowledge (Okada & Simon, 1997; Springer et al., 1999; Van Boxtel et al., 2000). When students collaborate, they can exchange ideas, ask questions, provide explanations, and negotiate. In carrying out the collaborative inquiry learning, learning requires preparation from students. The role of the teacher is as active as the role of students, and the teacher must be active in fulfilling the student needs. As long as the activities of collaborative inquiry such as lesson plan create the collaboration situation, encouragement, and motivation is the main task of the students (Urhahne, Schanze, Bell, Mansfield et al., 2010). The students who design the learning before teaching can contribute to the student understanding (Van Uum, Verhoeff, & Peeters, 2017). They must ensure that the learning environment including media and learning resources is according to the inquiry activities. They also need to master all of the devices or the materials used include the tools, teaching materials, and learning steps.

Hypotheses Development

There are three hypotheses proposed in this study as follows:

Hypothesis 1: There is a significant difference between the experimental group's pre-test and post-test scores in terms of critical thinking disposition.

Hypothesis 2: There is a significant difference between the control group's pre-test and post-test scores in terms of critical thinking disposition?

Hypothesis 3: There is a significant difference between the post test scores of the experimental group and the control group in terms of critical thinking disposition?

Research Method

Research Design

Quasi-experimental with pre-test / post-test control group design was used in this study. Four parallel classes were given intervention for 12 weeks from August to November 2019. Two parallel classes as the experimental groups were taught by collaborative inquiry learning. Meanwhile, the other two classes as the control group were taught using conventional inquiry. The inquiry and conventional collaborative learning were as the independent variables while the critical thinking disposition was as the dependent variable. The critical thinking disposition instrument was adapted to assess the critical thinking disposition of elementary school science teacher candidate students before and after the intervention.

Population and Sample

This study involved 149 students of the Elementary School Teacher Education program at Khairun University, Ternate, Indonesia. They are first year students who are taking the basic science courses. They were divided into two groups, namely the experimental group (N = 74) and the control group (N = 75). This division is based on data which obtained through the personal identity form and the pre-test score of critical thinking disposition. The results of the t-test sample of the independent sample of pre-test data showed that these two groups had the same critical thinking disposition ($t(149) = -0.528$; $p > 0.05$).

Data Collecting Instrument

In measuring critical thinking dispositions, an assessment instrument is used in the form of a questionnaire with a multilevel scale. The instrument was arranged in the form of a statement with a total of 45 items. The questionnaire statement originated from the seven habits of thought put forward by Facione, namely truth-seeking, open-mindedness, analytics, systematic curiosity, self-confidence and maturity. The instrument was arranged using a Likert scale (1 = "strongly disagree; 2 = disagree; 3). This instrument was developed by adapting from instruments that have been developed by [Sosu \(2013\)](#) and [Shin, Park, and Kim \(2015\)](#) but adapted or adjusted in the context of collaborative inquiry learning for student teacher candidates. This is because [Sosu \(2013\)](#) and [Shin et al. \(2015\)](#) focus more on critical thinking disposition in general. The research instrument can be seen in [Table 1](#).

Table 1

List of statements/questions used to measure critical thinking disposition [Sosu \(2013\)](#) and [Shin et al. \(2015\)](#)

No.	Questions/Statements
1	I think of quality ideas when discussing
2	I rarely think of new ideas in solving problems
3	I use more than one source to find information
4	I immediately accept other people's ideas without considering them
5	I like intellectually challenging things
6	I justify the choices that I make even without evidence
7	I try to understand how investigation works
8	I avoid negative things that affect my mind
9	I think that any opinion does not need any reason or evidence
10	I often think about my actions to see if I can fix them
11	I wisely take the decisions
12	I solve the problem based on systematically managed data
13	I lack of confidence in solving the problem
14	I am considering several alternatives to solve the problem
15	I defend the truth based on the evidence
16	I give reasons if I disagree with other people's opinions
17	I use appropriate reasons in taking the decisions
18	I often think about my actions to see if I can fix them
19	I immediately answer questions / solve problems before examining them first
20	I look for solutions based on various aspects
21	I am active in thinking
22	I express doubts about other people's ideas in a wise way
23	It bothers me a lot if I can't solve a problem
24	I usually check the source of information before making any judgments
25	I stick to my idea even though I don't have good reasons
26	I look for new ideas from various points of view
27	I feel it is important to justify the choices I make
28	I doubt the answers / ideas that I convey despite the evidence
29	I believe I can get through the tough problems
30	I feel it is not important to review what I have done
31	I turn my mistakes into opportunities to continue learning
32	I am quick in making the decisions without the support evidence
33	I am willing to accept the truth with the support evidence
34	I defend my own interests without considering the interests of others
35	I accept the different views
36	I reflect on and acknowledge other people's ideas
37	I justify the choices that I make even without evidence
38	I work based on the defined procedures / steps
39	I make my conclusions based on evidence
40	I think of difficult things so I forget things that are easy to do
41	I think of the answers to specific things
42	I reevaluate my experience so that I can learn from it
43	I am willing to accept the criticism of my opinion
44	I have my own way in solving the problems
45	I believe the ideas that I express can provide solutions

Procedures

This research begins with a focus group discussion (FGD) between lecturers, researchers and observers. FGD was conducted to ensure that all equipment, tools and media as well as supporting facilities had been prepared. The timing of the research and the division of tasks for the research team was also agreed upon during the FGD activities. After conducting the FGD, the researcher then contacted the students and took the initial action, namely making an agreement through filling out the study contract form, filling in the personal data instruments including name, place of birth date, gender, origin and so on. Furthermore, participants from the experimental group and the control group were given brief training on the procedures and steps of inquiry collaborative learning. The researcher also provides an explanation of the principles of teamwork.

The research process was set at an odd semester of 16 meetings, starting from the pre-test stage, the treatment stage until the post-test stage. The pre-test activity was carried out the first week by distributing a critical thinking disposition questionnaire to students one week before the treatment was carried out. Then, the treatment stage was carried out in the experimental group and the control group. At the first meeting, the teacher provided reinforcement of scientific method steps to strengthen the inquiry skills. A 14-weeks recovery session with a total of 340 lesson hours was conducted face-to-face, non-face-to-face, and field or laboratory investigation. Inquiry collaborative learning activities were designed to involve students in learning the concepts, designing investigations, carrying out the investigations in the laboratory or in an open environment and making the reports in groups. Each group member was given the time to prepare each unit of investigation activity by studying the information before lectures begin at the next meeting. The initial conceptual knowledge of each group member was used as material for group discussion in designing and conducting the investigation. The researcher designed the intervention and provided the instructor with all the necessary materials.

In this study, the collaborative inquiry learning steps were adapted from several sources such as [Cash, Dekoninck, and Ahmed-Kristensen \(2017\)](#); [Khine and Saleh \(2010\)](#); [Pedaste, Mäeots, Siiman, De Jong et al. \(2015\)](#). There are five phases of collaborative inquiry learning, namely the orientation phase, conceptualization, investigation, conclusion and discussion. The orientation phase is a process to identify and encourage students' curiosity about the topics being taught. In this phase, the instructor divides students into small groups heterogeneously, gives investigative tasks, and delivers instructions. They work in groups, share assignments, brainstorm, determine problems to solve and set common goals. Furthermore, in the conceptualization phase students discuss in groups to formulate the problems or questions and formulate hypotheses based on theory. This process is carried out by sharing common understanding of topics through communication and social interaction. The team members from each group describe the context of the investigation and their ideas to improve and develop the design plan. This process is called the investigative phase which briefly begins with the exploration activities, continues with experiments and ends with interpretation.

After the investigation phase, the next phase is the process of making the conclusions based on the data and comparing the conclusions based on the data with hypotheses or research questions. The findings are presented in the form of a report which will be discussed with other groups in the discussion phase.

Results and Discussion

Data Analysis

The Kolmogorov-Smirnov normality test was carried out for the first time in data analysis to test the normal distribution of the data. The test was continued with the variance homogeneity test using Levene to test the homogeneity of variance between groups. Based on the results of the normality test and the homogeneity test of variance, it will be determined whether the parametric test can be used or not. Parametric testing used paired t-test to compare the pre-test and post-test, then the independent t-test to compare between the groups.

The result of the Kolmogorov-Smirnov normality test in [Table 2](#) shows that the data used is normally distributed ($p > 0.05$) for all components of critical thinking disposition in each tested group, both

on the pre-test and post-test scores. Table 2 presents the result of the Levene test on the pre-test and post-test scores obtained by the experimental and control groups from CTD.

Table 2

The Result of Normality Test with Kolmogorov-Smirnov

Component			K-S	P
Anlitivity	Pre-test	Experimental	0.095	0.094
		Control	0.097	0.079
	Post-test	Experimental	0.085	0.200
		Control	0.094	0.095
CT-Self Confidence	Pre-test	Experimental	0.100	0.064
		Control	0.085	0.200
	Post-test	Experimental	0.091	0.200
		Control	0.088	0.200
Mature Judgement	Pre-test	Experimental	0.098	0.076
		Control	0.090	0.200
	Post-test	Experimental	0.096	0.090
		Control	0.093	0.171
Inquisitiveness	Pre-test	Experimental	0.091	0.200
		Control	0.094	0.098
	Post-test	Experimental	0.096	0.089
		Control	0.081	0.200
Open-mindedness	Pre-test	Experimental	0.094	0.176
		Control	0.097	0.075
	Post-test	Experimental	0.091	0.200
		Control	0.091	0.199
Systematicity	Pre-test	Experimental	0.097	0.079
		Control	0.083	0.200
	Post-test	Experimental	0.100	0.065
		Control	0.100	0.061
Truth-seeking	Pre-test	Experimental	0.087	0.200
		Control	0.092	0.184
	Post-test	Experimental	0.083	0.200
		Control	0.091	0.198
Total	Pre-test	Experimental	0.094	0.168
		Control	0.094	0.168
	Post-test	Experimental	0.090	0.200
		Control	0.090	0.200

Table 3

The Result of Variance Homogeneity Test with Levene

Component		F	df1	df2	P
Anlitivity	Pre-test	0.001	1	147	0.973
	Post-test	3.522	1	147	0.063
CT-Self Confidence	Pre-test	1.035	1	147	0.311
	Post-test	0.385	1	147	0.536
Mature Judgement	Pre-test	0.066	1	147	0.797
	Post-test	0.354	1	147	0.553
Inquisitiveness	Pre-test	0.156	1	147	0.693
	Post-test	0.007	1	147	0.932
Open-mindedness	Pre-test	0.166	1	147	0.684
	Post-test	3.463	1	147	0.065
Systematicity	Pre-test	2.640	1	147	0.106
	Post-test	1.349	1	147	0.247
Truth-seeking	Pre-test	1.778	1	147	0.184
	Post-test	3.491	1	147	0.064
Total	Pre-test	2.766	1	147	0.098
	Post-test	3.492	1	147	0.064

As shown in Table 3, the variance in the pre-test and post-test scores of the experimental and control groups of the total CTD component shows homogeneous data. In general, the results of the Kolmogorof-Smirnov goodness of fit and the Levene test reveal that the parametric test can be used to analyze data obtained from research. Table 3 presents the result of the independent sample t-test on the pre-test scores of the experimental and control groups of CTD.

The comparison result of the pre-test scores between the experimental group and the control group in Table 4 shows that there are no significant differences between all components tested ($df=147$; $p<0.05$).

Table 4

The Independent t-test Result on the Pre-test Scores between the Experimental Group dan Control Group

Component		N	M	SD	t
Anlitivity	Experimental	74	2.498	0.377	1.386
	Control	75	2.413	0.366	
CT-Self Confidence	Experimental	74	2.703	0.370	0.680
	Control	75	2.658	0.431	
Mature Judgement	Experimental	74	2.270	0.355	0.472
	Control	75	2.242	0.373	
Inquisitiveness	Experimental	74	2.516	0.406	-0.225
	Control	75	2.531	0.428	
Open-mindedness	Experimental	74	2.541	0.441	-1.039
	Control	75	2.618	0.466	
Systematicity	Experimental	74	2.523	0.363	-1.572
	Control	75	2.627	0.440	
Truth-seeking	Experimental	74	2.511	0.455	-1.525
	Control	75	2.617	0.393	
Total	Experimental	74	2.509	0.214	-0.528
	Control	75	2.529	0.241	

* $p<0.05$

The comparison of the pre-test and post-test scores in the experimental group in Table 5 shows that there are significant differences in all components tested ($df=73$; $p<0.05$).

Table 5

The Results of Paired t-test on the Pre-test and Post-test Values in the Experimental Group

Component		N	M	SD	t
Anlitivity	Pre-test	74	2.498	0.377	-14.105
	Post-test	74	3.329	0.437	
CT-Self Confidence	Pre-test	74	2.703	0.370	-10.504
	Post-test	74	3.387	0.450	
Mature Judgement	Pre-test	74	2.270	0.355	-18.723
	Post-test	74	3.421	0.439	
Inquisitiveness	Pre-test	74	2.516	0.406	-13.880
	Post-test	74	3.547	0.450	
Open-mindedness	Pre-test	74	2.541	0.441	-14.847
	Post-test	74	3.504	0.442	
Systematicity	Pre-test	74	2.527	0.367	-13.798
	Post-test	74	3.493	0.492	
Truth-seeking	Pre-test	74	2.511	0.455	-14.230
	Post-test	74	3.509	0.461	
Total	Pre-test	74	2.509	0.214	-21.146
	Post-test	74	3.456	0.338	

* $p<0.05$

The comparison result of the pre-test and post-test scores in the control group in Table 6 shows that there are significant differences in all components tested. The post-test mean score which was higher than the pre-test mean score indicated that the treatment carried out in the control group had a significant effect on the increase in the value of each component.

Table 6

The Paired t-test Result on Pre-test dan Post-test Scores in the Control Group

Component		N	M	SD	t
Anliticality	Pre-test	75	2.413	0.366	-14.668
	Post-test	75	3.151	0.355	
CT-Self Confidence	Pre-test	75	2.658	0.431	-9.077
	Post-test	75	3.124	0.426	
Mature Judgement	Pre-test	75	2.242	0.373	-16.181
	Post-test	75	3.211	0.489	
Inquisitiveness	Pre-test	75	2.531	0.428	-13.763
	Post-test	75	3.353	0.451	
Open-mindedness	Pre-test	75	2.618	0.466	-12.458
	Post-test	75	3.316	0.361	
Systematicity	Pre-test	75	2.627	0.440	-11.893
	Post-test	75	3.324	0.426	
Truth-seeking	Pre-test	75	2.618	0.393	-15.044
	Post-test	75	3.356	0.372	
Total	Pre-test	75	2.529	0.241	-25.480
	Post-test	75	3.263	0.271	

* p<0.05

The results of the comparison of post-test scores between the experimental group and the control group in Table 7 show that there are significant differences in all components tested. The average value of the experimental group which is higher than the average value of the control group indicates that the treatment carried out in the experimental group has a better effect on increasing the value of each component.

Table 7

The results of the Independent t-test on the Post-test Scores between the Experiment Group and the Control Group

Component		N	M	SD	t
Anliticality	Experimental	74	3.329	0.437	2.722
	Control	75	3.151	0.355	
CT-Self Confidence	Experimental	74	3.387	0.450	3.665
	Control	75	3.124	0.426	
Mature Judgement	Experimental	74	3.421	0.439	2.760
	Control	75	3.211	0.489	
Inquisitiveness	Experimental	74	3.547	0.450	2.629
	Control	75	3.353	0.451	
Open-mindedness	Experimental	74	3.504	0.442	2.858
	Control	75	3.316	0.361	
Systematicity	Experimental	74	3.493	0.492	2.242
	Control	75	3.324	0.426	
Truth-seeking	Experimental	74	3.509	0.461	2.237
	Control	75	3.355	0.372	
Total	Experimental	74	3.456	0.338	3.857
	Control	75	3.263	0.271	

* p<0.05

Theoretical Implication

This study reveals the results that in basic science courses, collaborative inquiry learning has a significant impact on the achievement of students' critical thinking dispositions. The collaborative inquiry learning approach makes students' critical thinking dispositions more accessible than conventional approaches. This may be triggered by the collective involvement of learners in the

meeting common goals. As a pedagogic approach, collaborative inquiry emphasizes the constructivist paradigm, in which learners obtain the new information from their peers and encourage the recall of knowledge and subject matter so as to contribute to the academic performance and more effective learning attitudes (Cooper, 2006). Several studies suggest that collaborative learning combined with the investigative and problem-solving activities contributes to the cognitive and affective learning outcomes (Pramusinta, Setyosari, Widiati, & Kuswandi, 2019; SUKMAWATI, SETYOSARI, SULTON, & PURNOMO, 2019).

In the collaborative inquiry learning strategy, the learners engage collectively in exploring the material with their peers, acquire the new knowledge, compare their opinions with peers, evaluate the various perspectives and improve their problem-solving skills. This involvement encourages the students to develop analytical attitudes and teamwork, thereby enhancing their ability to think critically. This is consistent with Piaget (2002) and in line with Fung (2017) research. Piaget (2002) showed that cognitive dissonance, which is usually caused by peer social interactions, plays an important role in the cultivation of cognitive growth and amplifies the effects of learning. In this sense, the collaborative group work can be thought of as peer to peer interactions that promote the decision-making and shared the responsibility through the cognitive conflict. Fung (2017) proves that collaborative learning environments can help the learners in developing new ideas by emphasizing the important role of arguments in stimulating the critical thinking disposition.

In addition, Cheng and Wan (2017) also argued that the active involvement of learners in the exchange of contextual ideas to plan, design and conduct experiments can have a positive impact on the critical thinking attitudes. This practice reflects the application of constructivist theory, in which learners independently engage in collective work and experimental studies to acquire high-level abilities.

The results of the data analysis confirmed that the post-test mean score was higher than the pre-test mean score, indicates that the treatment carried out in the experimental group had a significant effect on the increase in the value of each component. The total average pre-test and post-test scores obtained from the experimental group $t(74) = 0.000$; $p < 0.05$. The total post-test mean score of the experimental group ($M = 3.456$, $SD = 0.338$) was found higher than the pre-test average score ($M = 2.509$; $SD = 0.214$). These findings indicate that the science course carried out with collaborative inquiry is effective in increasing the critical thinking disposition of science teacher candidate students. The results of data analysis also show that there are differences in critical thinking dispositions between students involved in collaborative inquiry strategies and conventional strategies.

On the other hand, although the average score for the seven components of critical thinking disposition was not much different in the experimental group, the inquisitiveness component obtained an average score higher than the other components while the lowest was the analyticity component. The high of inquisitiveness component is because the students are enthusiastic about designing their investigative activities, they intensely ask questions and discuss. Conversely, the analyticity component was lower than the other components because the students were less encouraged to develop arguments based on the evidence.

Practical Implication

Inquiry collaborative learning helps the learners to solve the problems while developing awareness and increasing their success through experiences ultimately contributing to a productive mindset. During the inquiry exercise, the learners' awareness will be increased as they are directly involved in developing content, finding problems, designing investigations, and finding answers. Students in the collaborative inquiry learning strategy group engaged in collaborative inquiry are very interested in creating and building the arguments. They seek to find the evidence of their friends' opinions by sharing claims and input the statements and participating in the discussions.

This performance is inseparable from the instructor's role in regulating and encouraging the learners' cooperation during the investigation. The learners have designed the collaborative spaces for them to create their own experiences and ideas, which ultimately regulates the need for a more targeted scaffold to address challenges that experienced by the learners and direct them in specific directions in a phase with the structure. Learner assistance such as providing structure and space in the collaborative inquiry phase can increase learners' willingness to collaborate. In a broader sense, the learner's role in inquiry collaborative learning is very important.

Learners can guide the students towards open-mindedness and self-confidence in the face of differences, sometimes even conflicting opinions. For example, when a student is a bit too enthusiastic in denying the opinion of his classmate, it results in a tense group atmosphere, thus requiring the learner's role to break the atmosphere, minimize the tension and encourage the group to continue the discussion. Furthermore, when the learners acknowledge one student's informative comments with a tone of agreement, other students are motivated to contribute thoughtful responses to get the similar treatment.

On the other hand, although taught using conservative and learner-centered methods, students in the control class had a pessimistic attitude. This can happen because large classes reduce the involvement of learners in the learning process. Researcher considers that the students-focused teaching is less successful because of the minimal interaction between student and student and between learner and students and also between students and the surrounding environment. The conventional learning environment does not provide opportunities for students to share, criticize or review the arguments. Many researchers argued that attitudes with views of cognitive, affective and individual behavior organized through previous experiences shape one's perspective on a particular problem. This means that attitudes are related to good experiences for students, whether they find the investigative activity interesting or not and how much activity they can do (Baseya & Francis, 2011). When students do not enjoy learning, they tend to negatively affect their academic performance. Therefore, it can be stated that the learning environment determines the students' attitudes in both groups.

Conclusion

Collaborative learning integrated with inquiry can encourage prospective elementary school teacher students to hone scientific skills such as critical thinking, collaborative thinking and problem solving. This also has an impact on developing the critical thinking dispositions and improving the quality of primary school teacher education. The results of the study prove that the collaborative inquiry learning strategy is effective in increasing the critical thinking disposition than the conventional learning. Thus, the contribution of this study is to fostering teacher candidates who are ready to teach their students to think critically. Given the educational needs of primary school teachers, adopting a collaborative inquiry strategy can have a central role in developing analytical, systematic, transparency, maturation and open skills. The limitation of this study is using small sample size, so it will be a consideration to generalize the results. Besides, this study only focus on elementary school teacher. Future research can be carried out by including larger sample size and also applying the research regarding the collaborative inquiry learning to the other school such as secondary school or high school. Furthermore, it is necessary to study the utilization of computer technology to assist online collaborative inquiry learning activities to guide prospective teacher students towards longlife learners.

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